

MAP READING



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Key Points

- **Map Information**
- **Scale Introduction**
- **Coordinate Systems**

MAP

Meaning and Definition

- A map is a symbolic depiction emphasizing relationships between elements of some space, such as objects, regions, or themes.
- A map is a symbolic representation of selected characteristics of a place, usually drawn on a flat surface’.
- The graphic representation of the geographical setting.

Basic Characteristics of Maps

- **LOCATION** – are positions in two dimensional space (x, y).
- **ATTRIBUTES** are qualities or magnitudes (languages, temperature)
 1. Relationship between Location with no attribute
 2. Relationship among various attribute at one location
 3. Among locations of attributes at given space
 4. Among the location of derived attributes

- All geographical Maps are **reduction (Scale)**
- All maps involve geometric **transformation (Projection)**
- All maps are **abstraction**
- All maps adhere to **symbolism**

Types and purpose of Maps

- Primary objective is to store geographic Information in spatial format
- Serves mobility and navigation needs
- Serves analytical purpose involving measuring and computing
- Assist in spatial forecast/thinking

Types of Map

Maps have many functions and faces, and each of us sees with different eyes.

Classified by 3 different point of View

- Classed by Scale
- Classed by Function
- Classed by subject matter

General Purpose Map

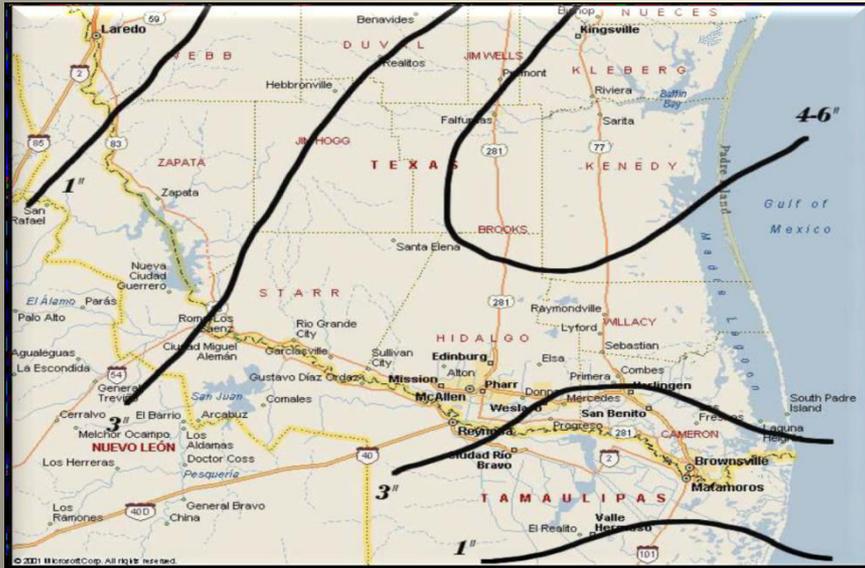
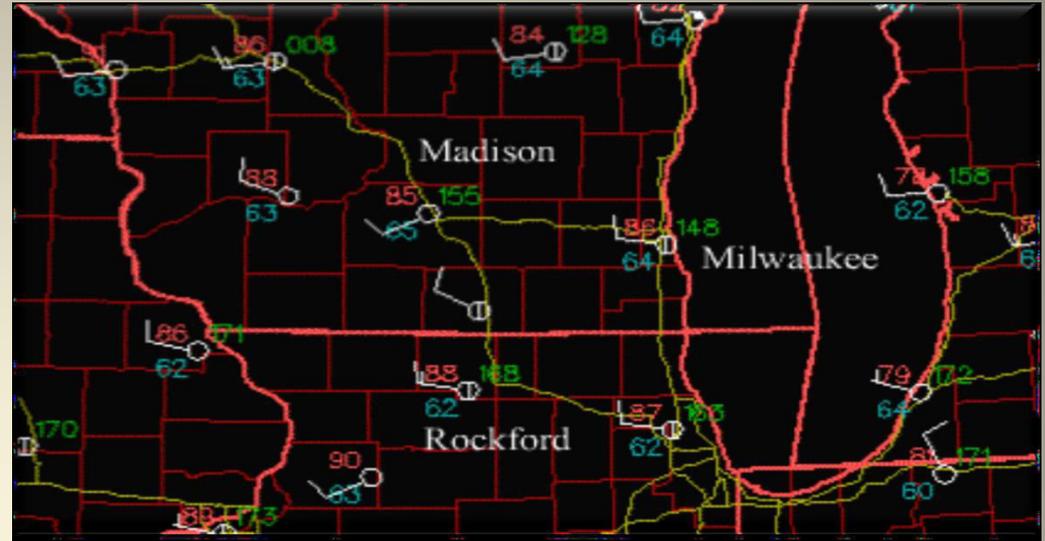


Topographic Map

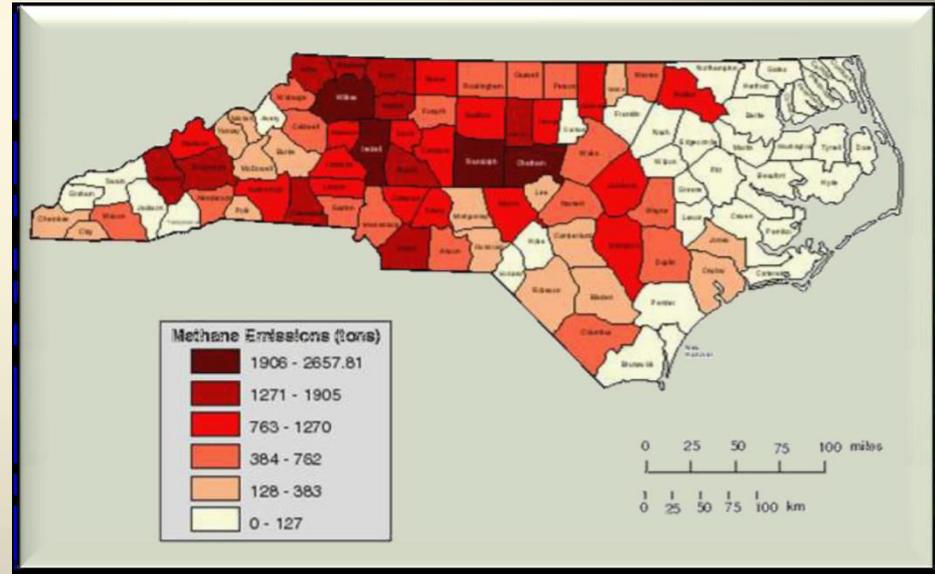
Depict the form & relief of the surface &/or general features, such as roads, buildings, and political boundaries.



- **Thematic Map**
Spatial Dimension of
Particular theme



Isopleth

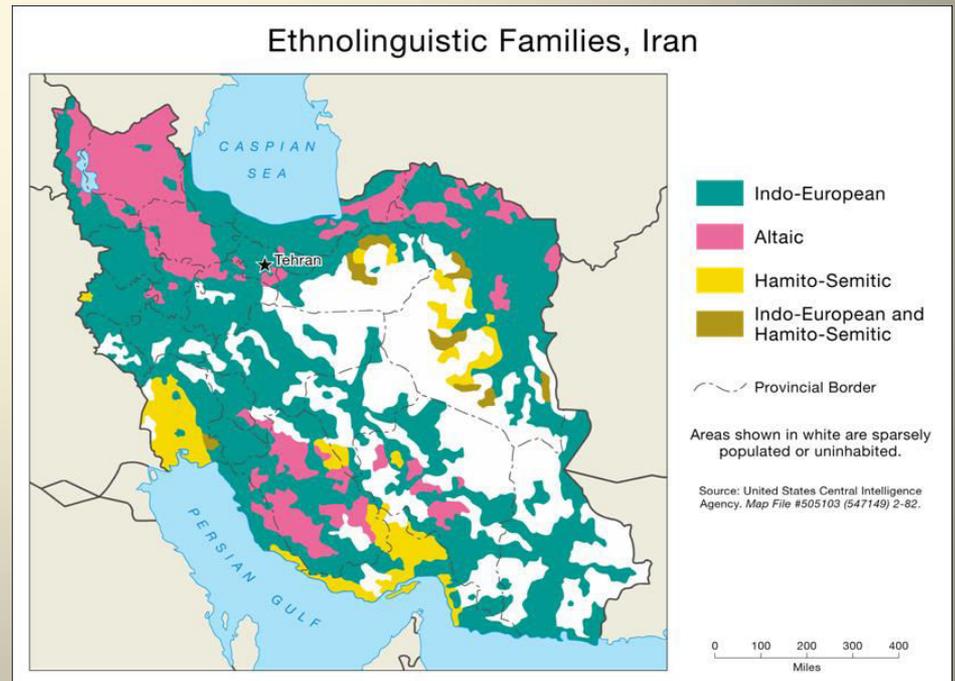


Choropleth

MAP ELEMENTS

- The building blocks of *Cartographic Communication*
 - The transmission of geographic information through the use of maps
- All maps are created from a common set of map elements

Example Map



MAP ELEMENTS

1. Frame Line and Neat Line
2. Mapped Area
3. Inset
4. Title and Subtitle
5. Legend
6. Data Source
7. Scale
8. Orientation



Decrease in size from
top to bottom

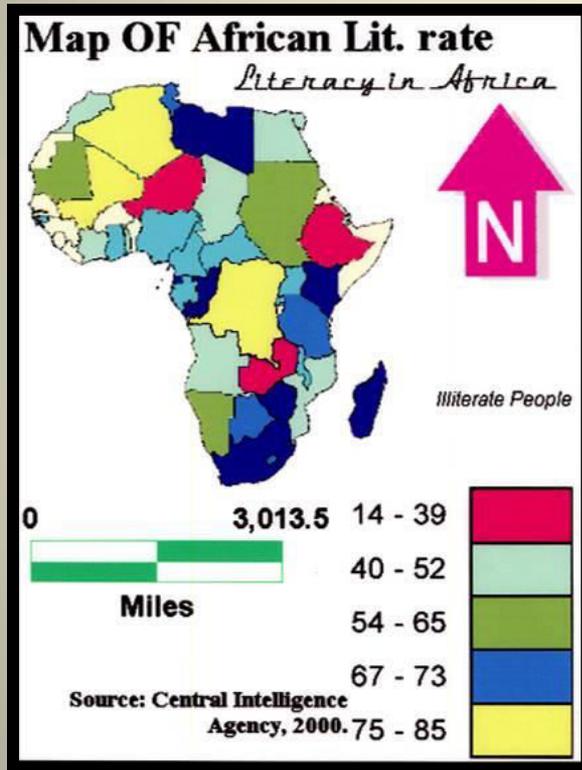
**Listed in the
recommended order** of
placement: larger first,
smaller last

MAP ELEMENTS

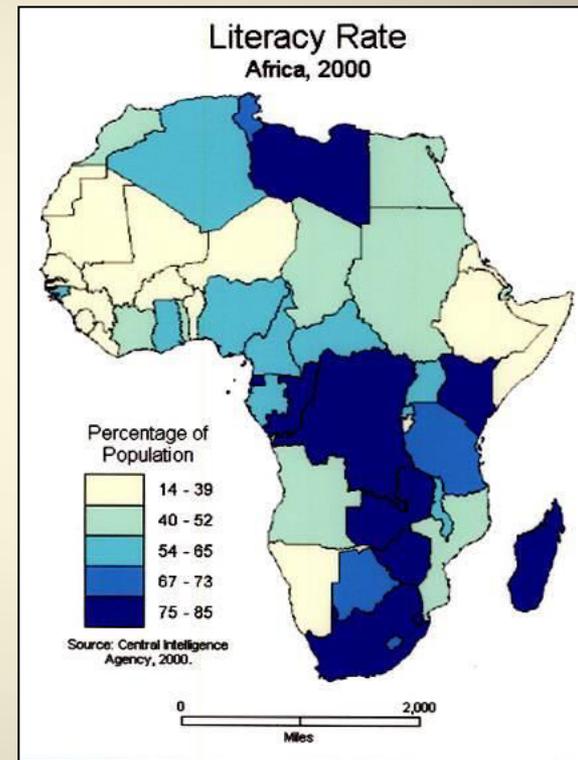
- It is the cartographer's job to make all decisions regarding map elements
 - Which to include, and which to omit
 - How to implement them in the most appropriate manner
- Virtually every decision the cartographer makes is guided by
 - The map user (the intended audience)
 - The purpose of the map

MAP ELEMENTS

- Map Noise and Communication



A noisy, inefficient communicator



A simple, efficient communicator

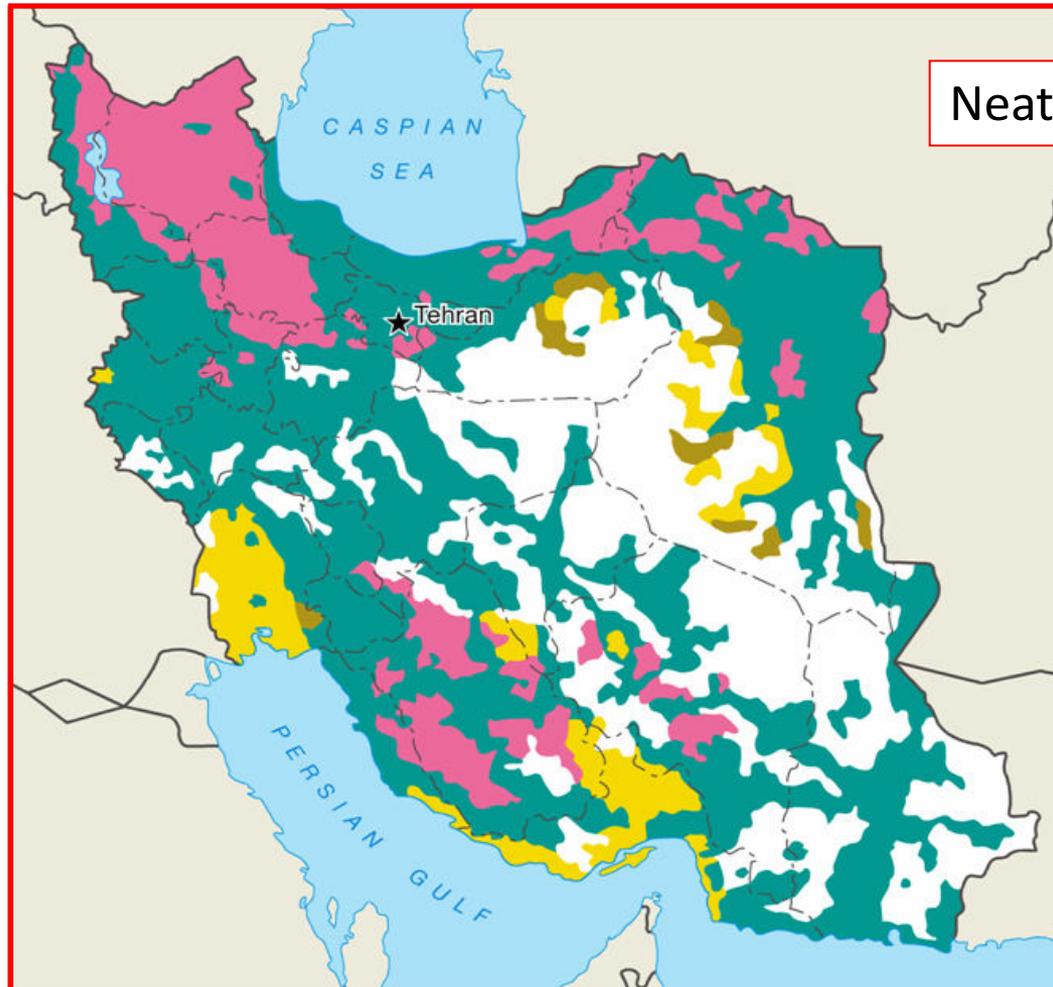
FRAME LINE and NEAT LINE

FRAME LINE and NEAT LINE

- Help to organize the map's contents, and define its extent
- Frame Line
 - Encloses all other map elements
 - Should be the first map element placed, because it occupies the most area, and defines the initial available space
- Neat Line
 - Is used to crop (limit the extent of) the mapped area

FRAME LINE and NEAT LINE

Ethnolinguistic Families, Iran



Neat Line

Frame Line

- Indo-European
- Altaic
- Hamito-Semitic
- Indo-European and Hamito-Semitic

Provincial Border

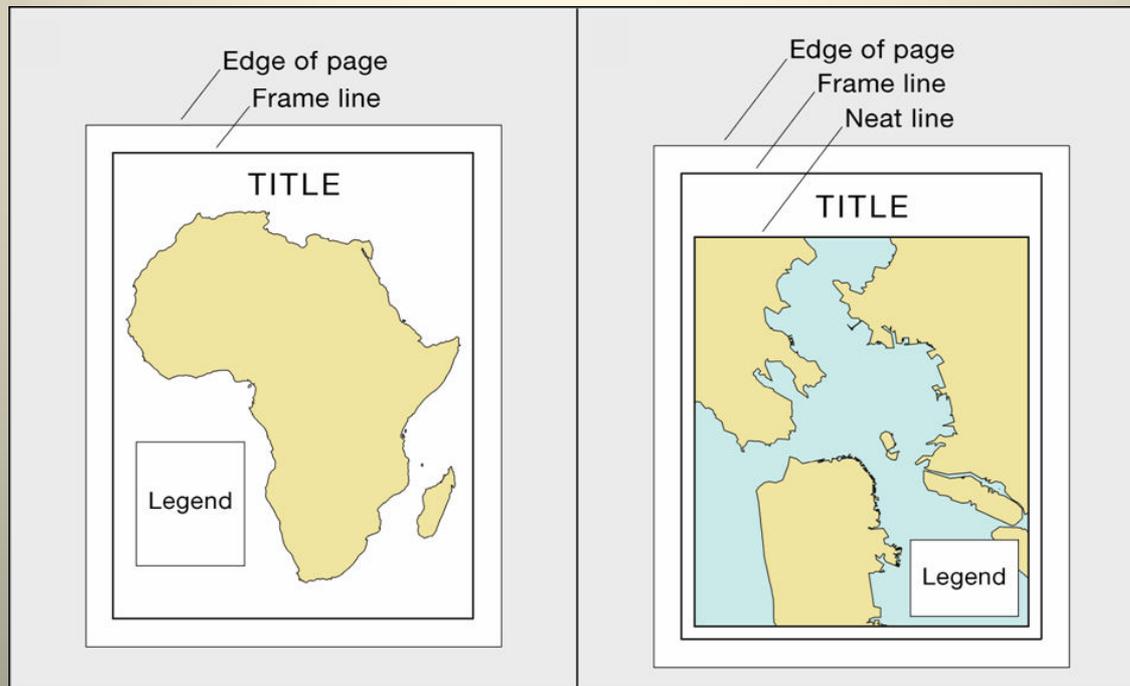
Areas shown in white are sparsely populated or uninhabited.

Source: United States Central Intelligence Agency. Map File #505103 (547149) 2-82.

0 100 200 300 400
Miles

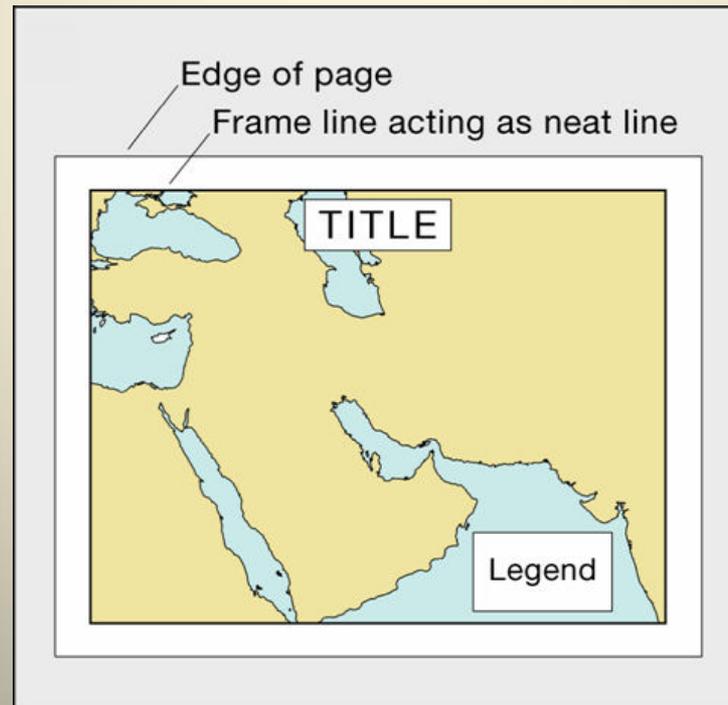
FRAME LINE and NEAT LINE

- A Frame Line should be used in most situations
- A Neat Line is used when the mapped area needs to be cropped



FRAME LINE and NEAT LINE

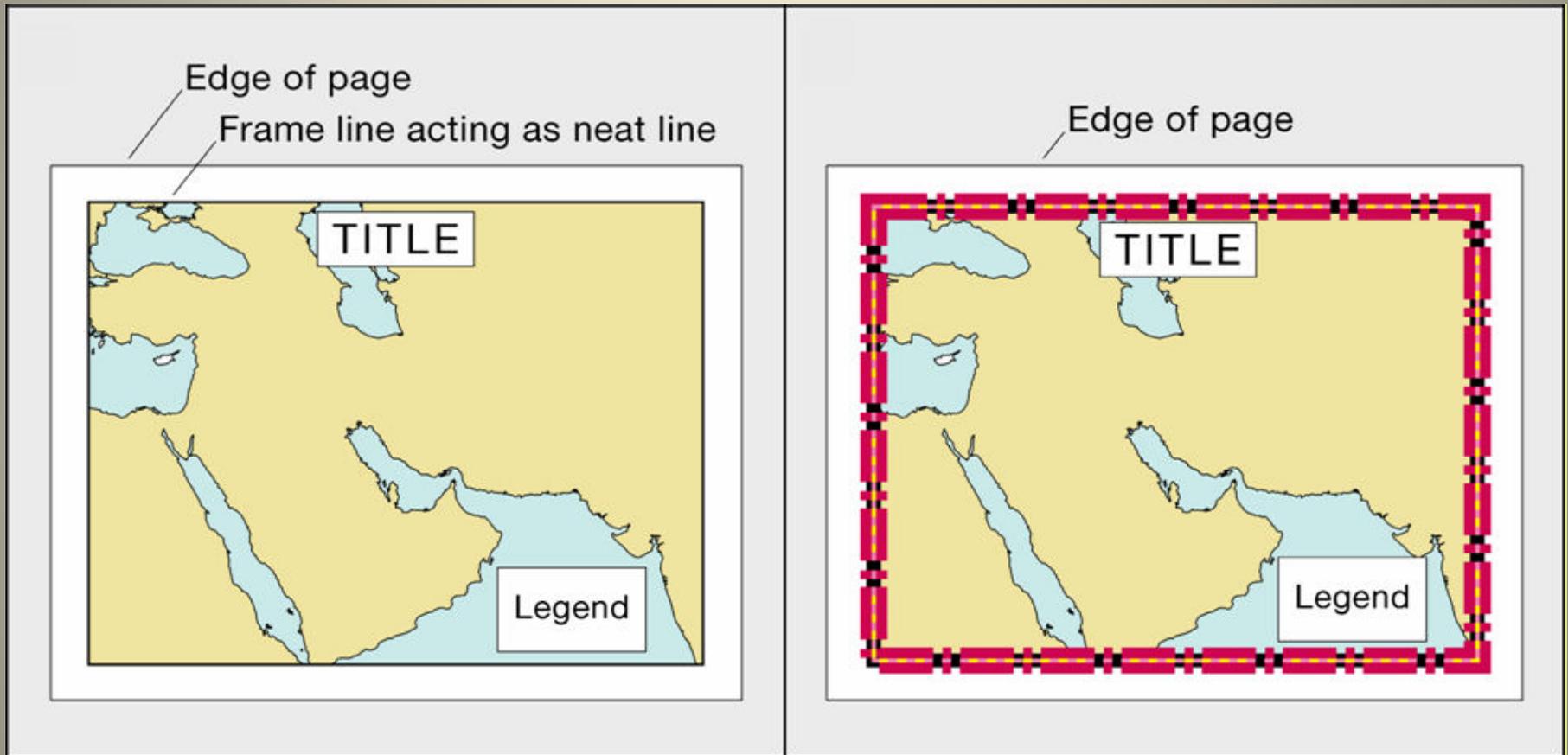
- In certain cases, a frame line can also act as a neat line
 - Enclosing all map elements *and* cropping the mapped area



FRAME LINE and NEAT LINE

- The style of these lines should be subtle
 - A single, thin, black line should be used in most cases
 - Slightly thicker lines are appropriate when working with larger formats, such as wall maps and posters
 - These lines should focus attention not on themselves, but on what is within them

FRAME LINE and NEAT LINE



Note: The edge of the page will not be shown on most subsequent maps

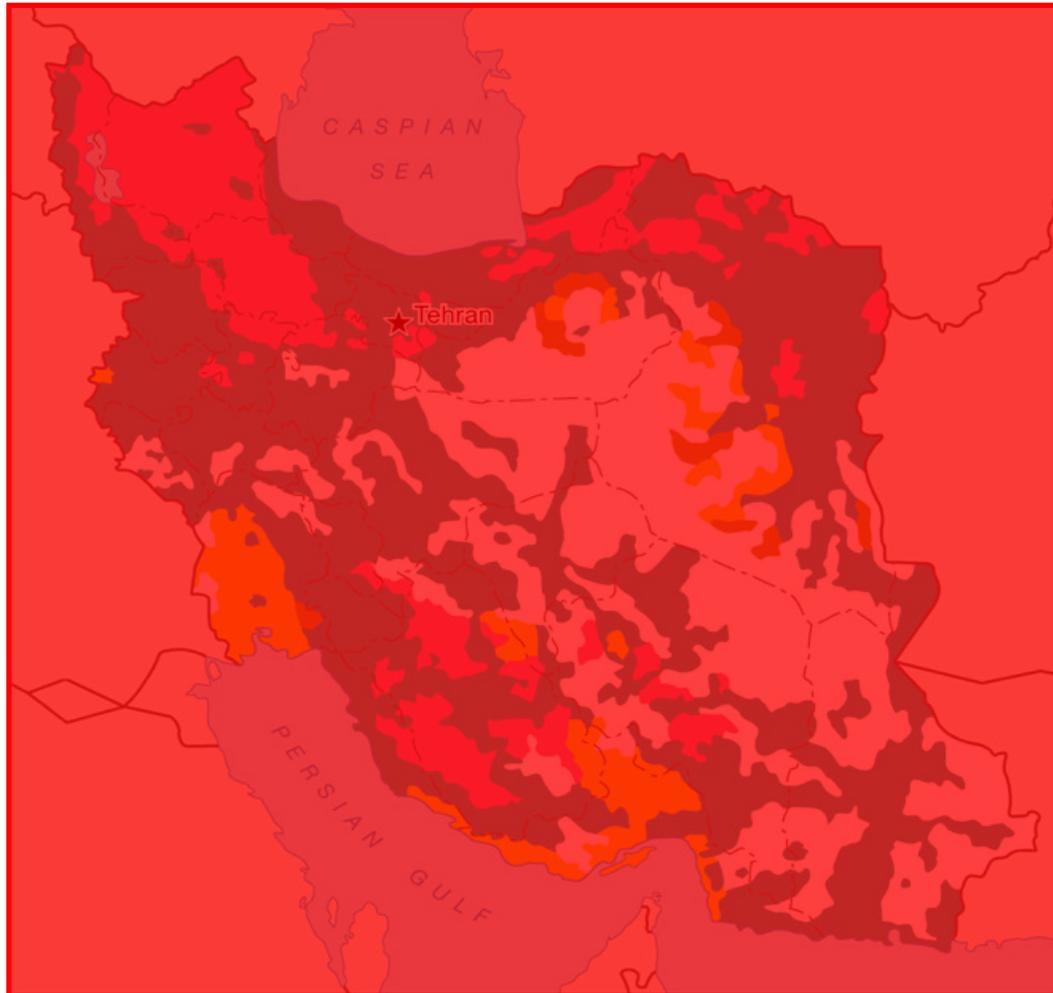
MAPPED AREA

MAPPED AREA

- The region of Earth being represented
- Consists of Thematic Symbols
 - Thematic Symbols directly represent the map's theme
 - Are visually dominant
- Can also include Base Information
 - Base Information provides a geographic frame of reference for the theme
 - Is subdued

MAPPED AREA

Ethnolinguistic Families, Iran



- Indo-European
- Altaic
- Hamito-Semitic
- Indo-European and Hamito-Semitic

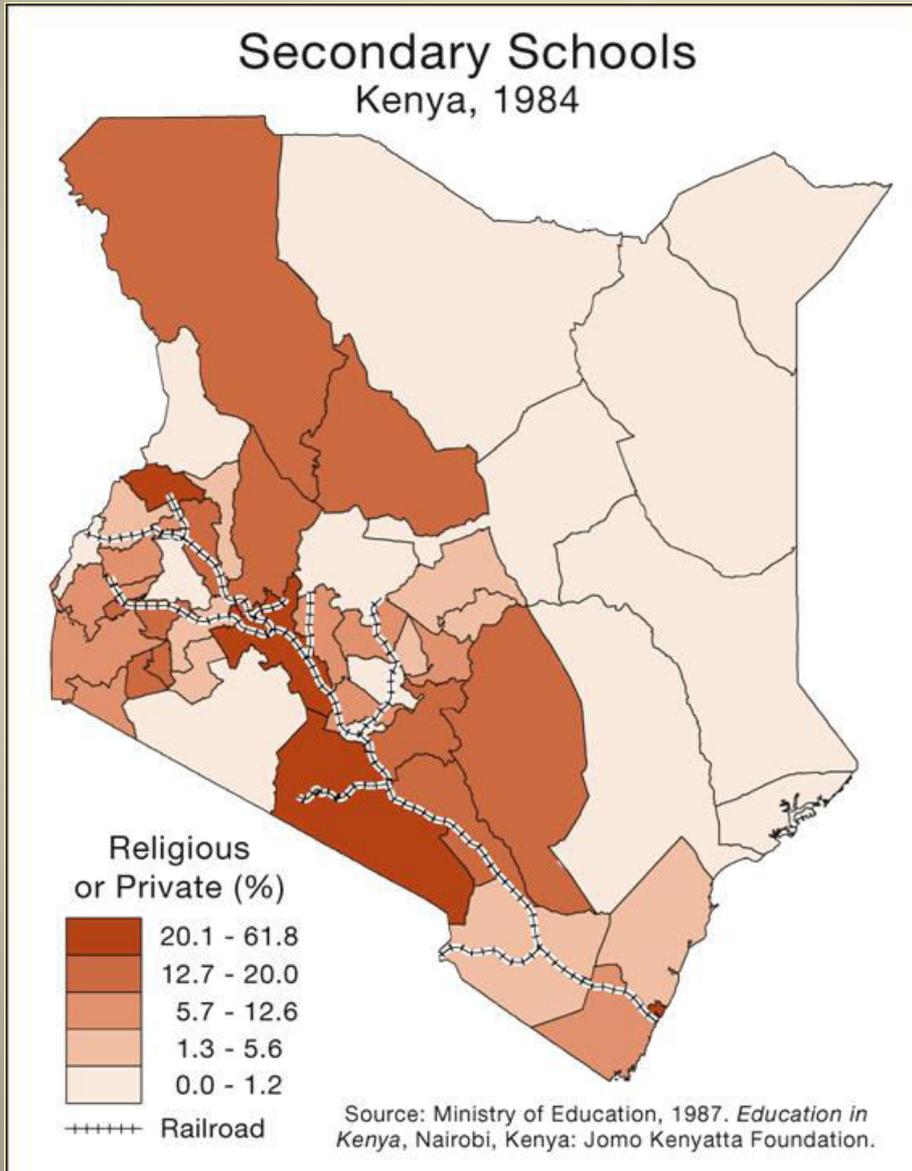
Provincial Border

Areas shown in white are sparsely populated or uninhabited.

Source: United States Central Intelligence Agency. Map File #505103 (547149) 2-82.

0 100 200 300 400
Miles

MAPPED AREA



Thematic Symbols:
Shaded Polygons

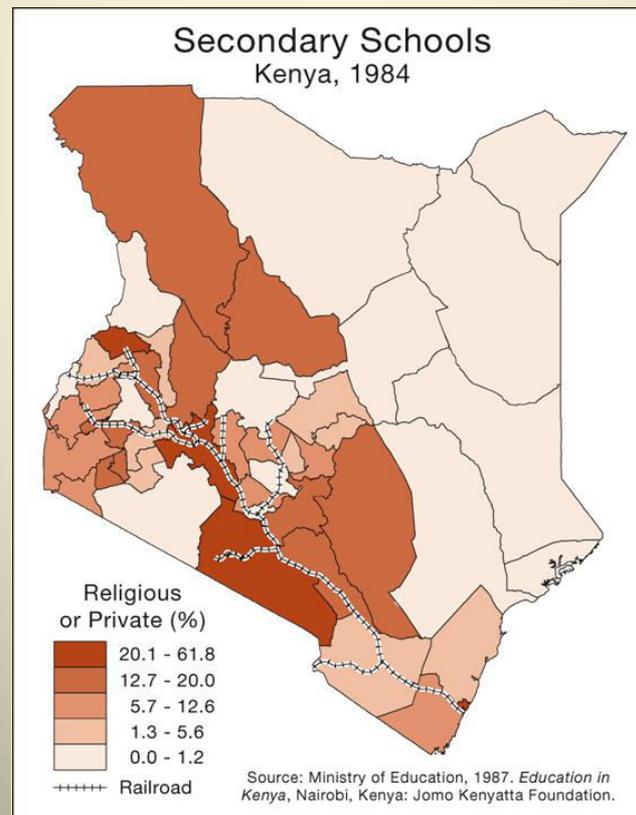
Base Information:
Railroads

MAPPED AREA

- There are two varieties of mapped area, distinguished by how they represent the geographic region of interest
 - Floating
 - Cropped

MAPPED AREA

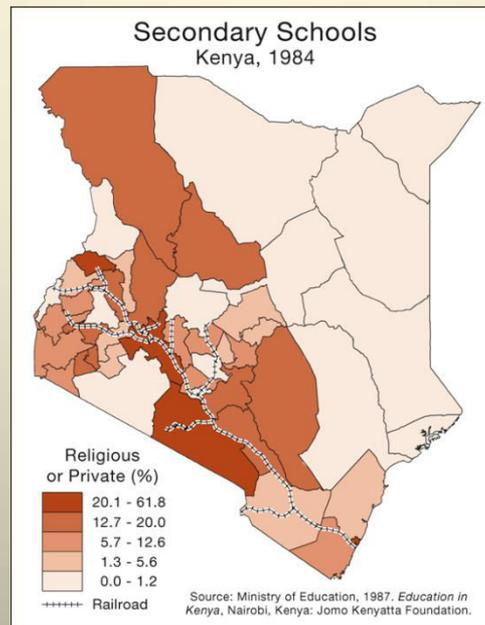
- Floating Mapped Area
 - Region of interest is disconnected from neighboring regions



Closed Form:
Bounding Polygon

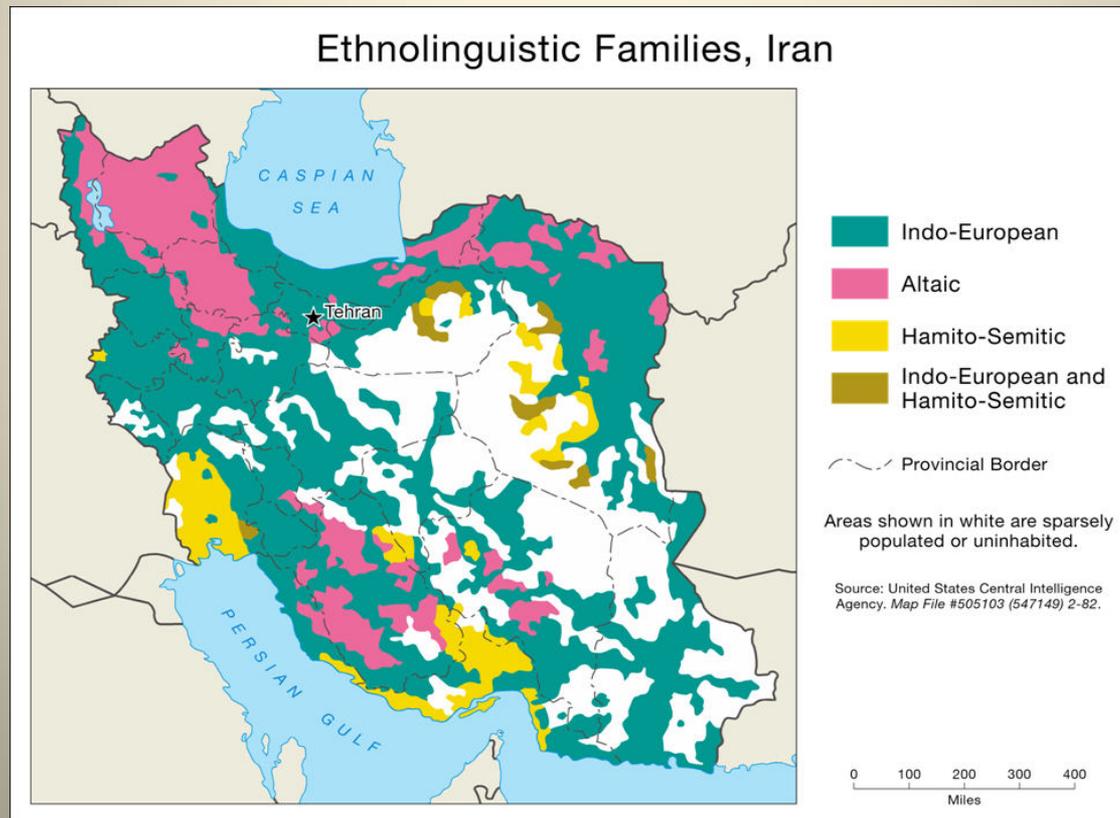
MAPPED AREA

- Floating Mapped Area (cont.)
 - Produces available space that often eases the placement of other map elements
 - Removes the region from its geographic context, possibly confusing the map user



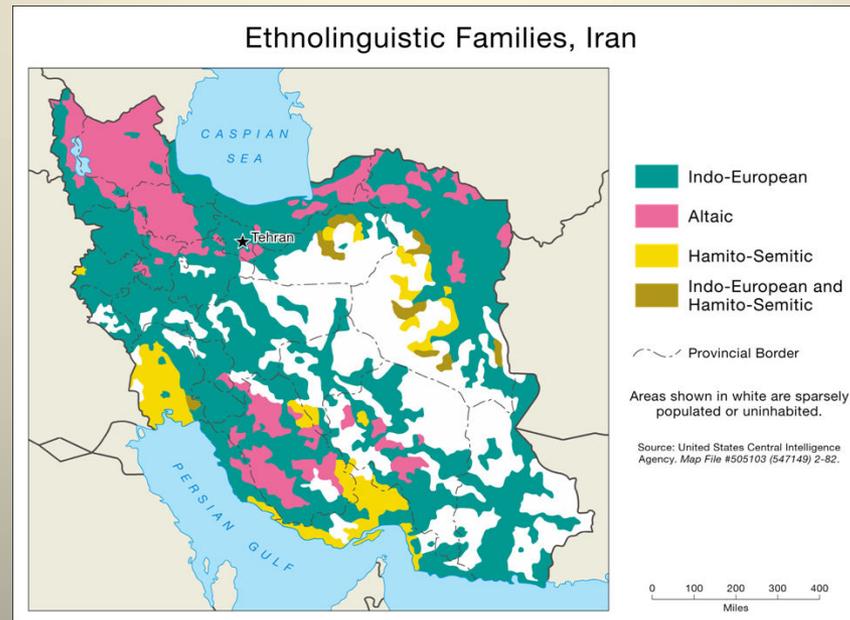
MAPPED AREA

- Cropped Mapped Area
 - Represents the region of interest within its geographic context



MAPPED AREA

- Cropped Mapped Area (cont.)
 - More realistic, less abstract
 - Can make the placement of other map elements more difficult due to a lack of available space

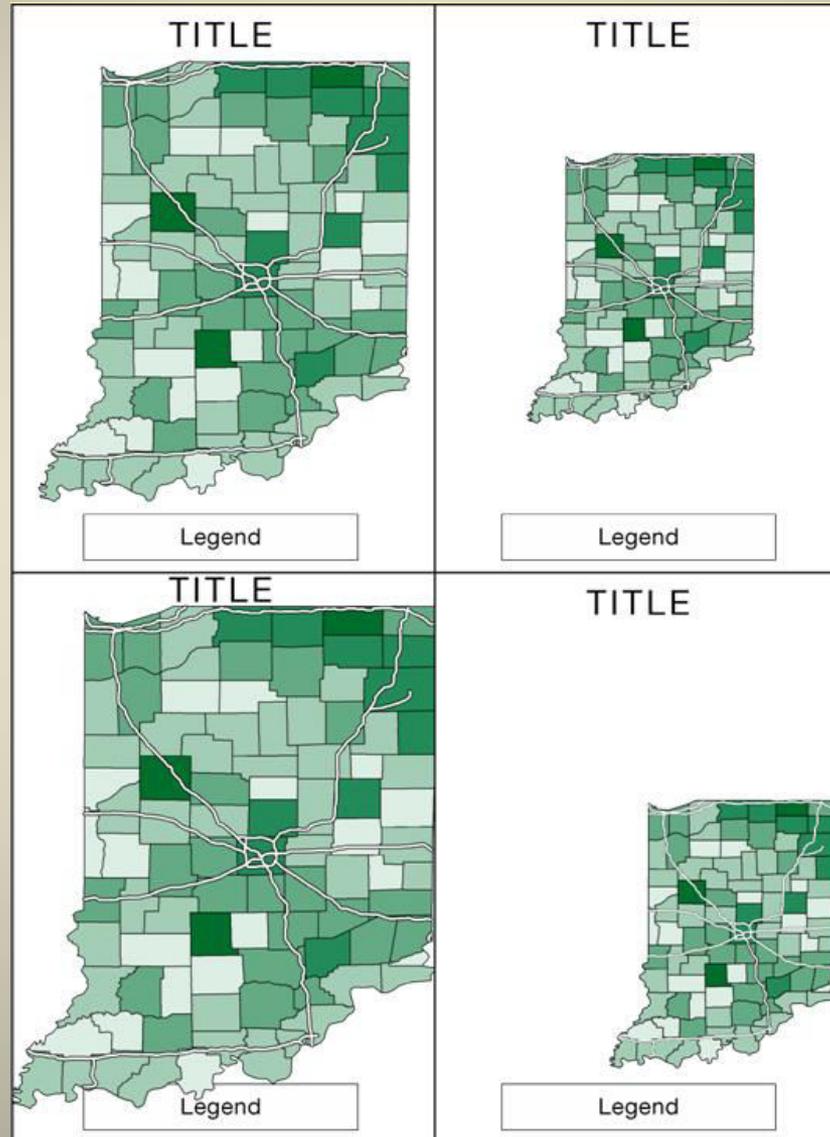


MAPPED AREA

- Make the mapped area as large as possible within the available space
 - Without being “too close” to the frame line
 - While leaving ample room for the remaining map elements
- Maximum area is important
 - The mapped area—thematic symbols in particular—is instrumental in communicating the map’s information

MAPPED AREA

Appropriately
Sized

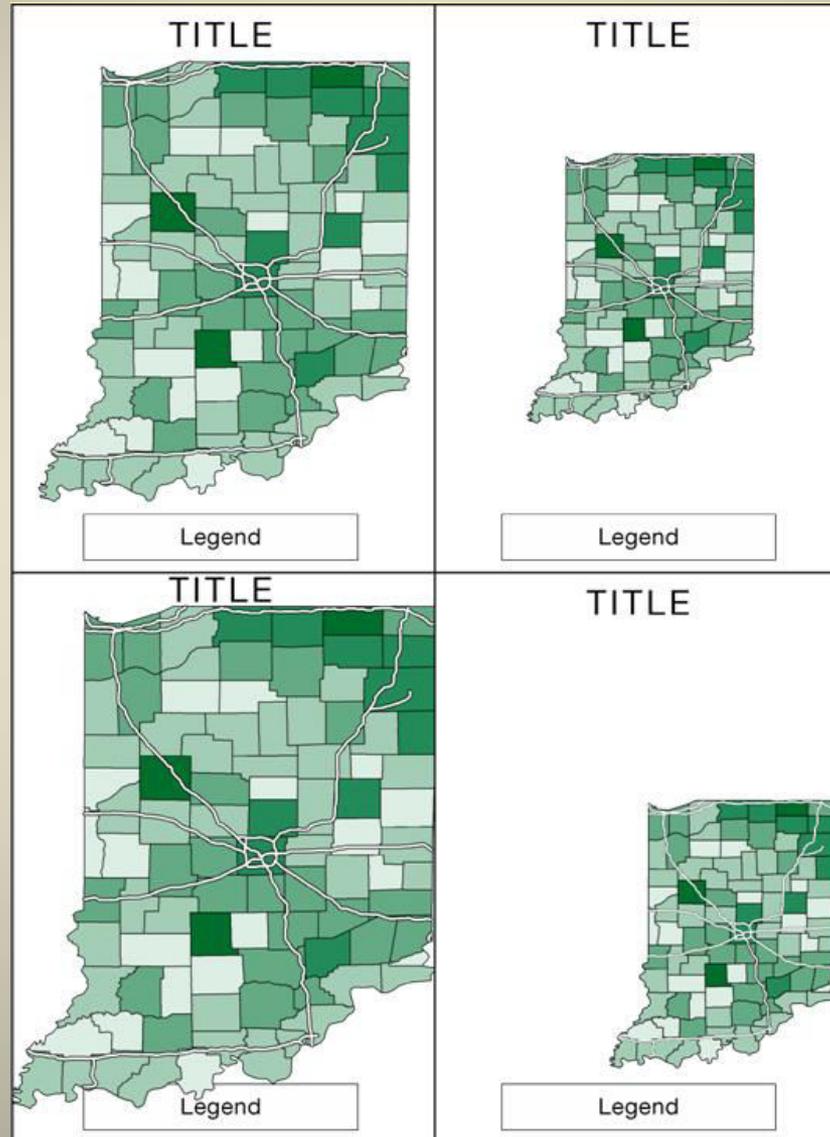


MAPPED AREA

- Try to visually center the mapped area both horizontally (side-to-side) and vertically (top-to-bottom)
 - Within the available space, as defined by the frame line
- This will not always result in an appropriate placement
 - But should be tried first

MAPPED AREA

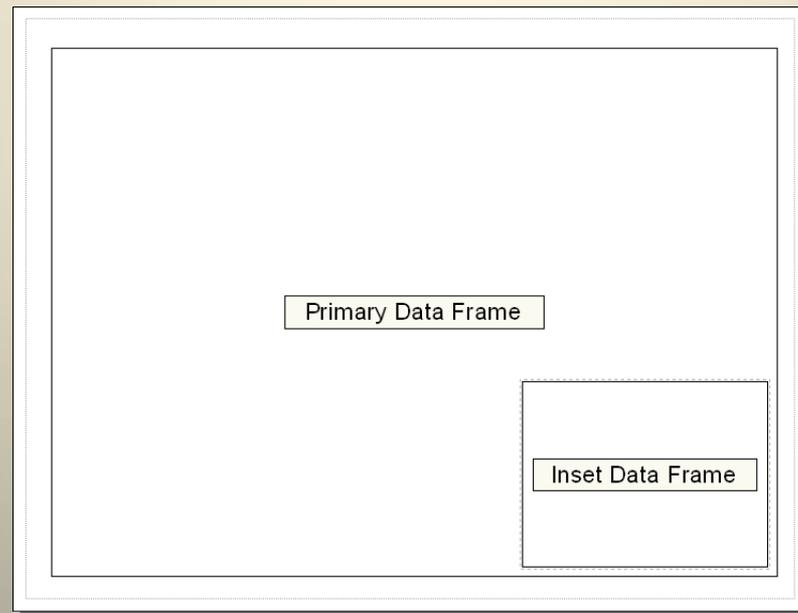
Appropriately
Centered



INSET

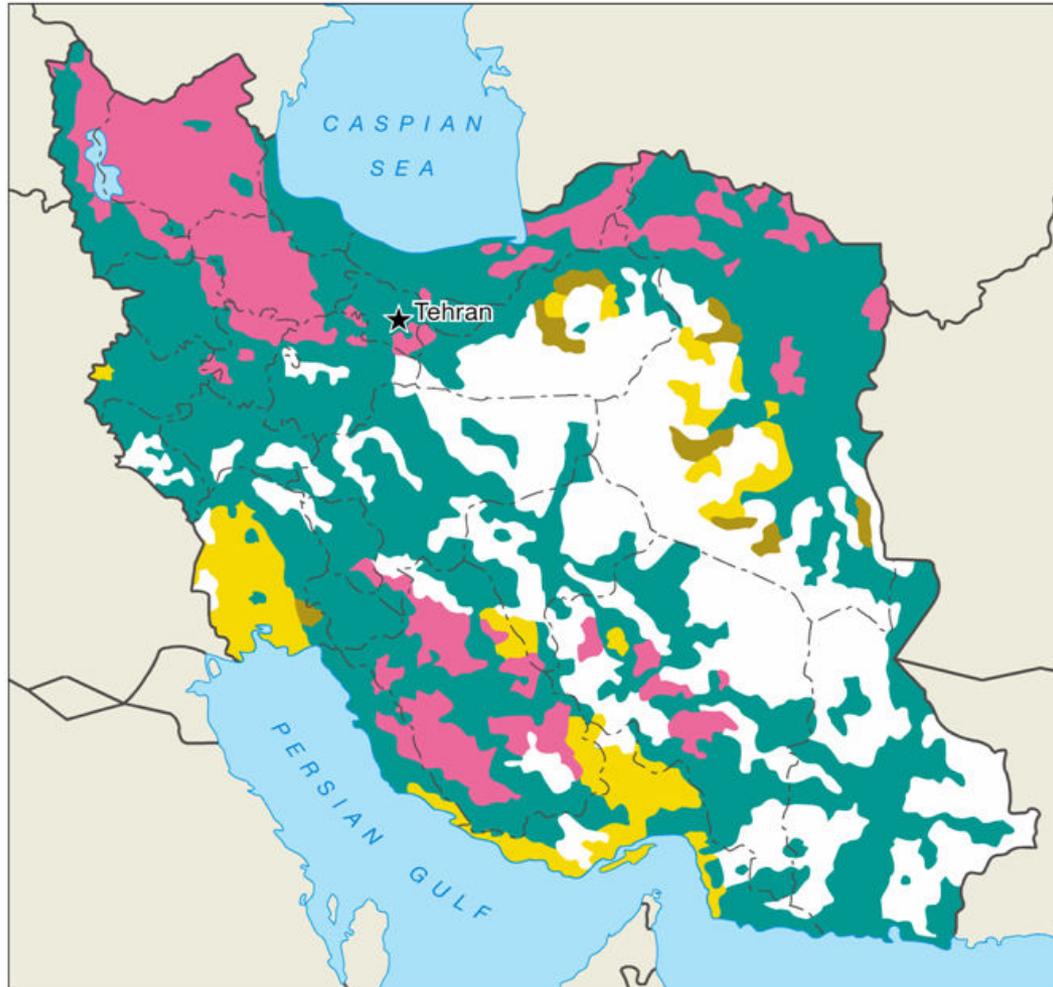
INSET

- A smaller map included within the context of a larger map
 - Can serve several purposes
 - In the world of ArcGIS, the inset is usually a separate data frame



INSET

Ethnolinguistic Families, Iran



- Indo-European
- Altaic
- Hamito-Semitic
- Indo-European and Hamito-Semitic

Provincial Border

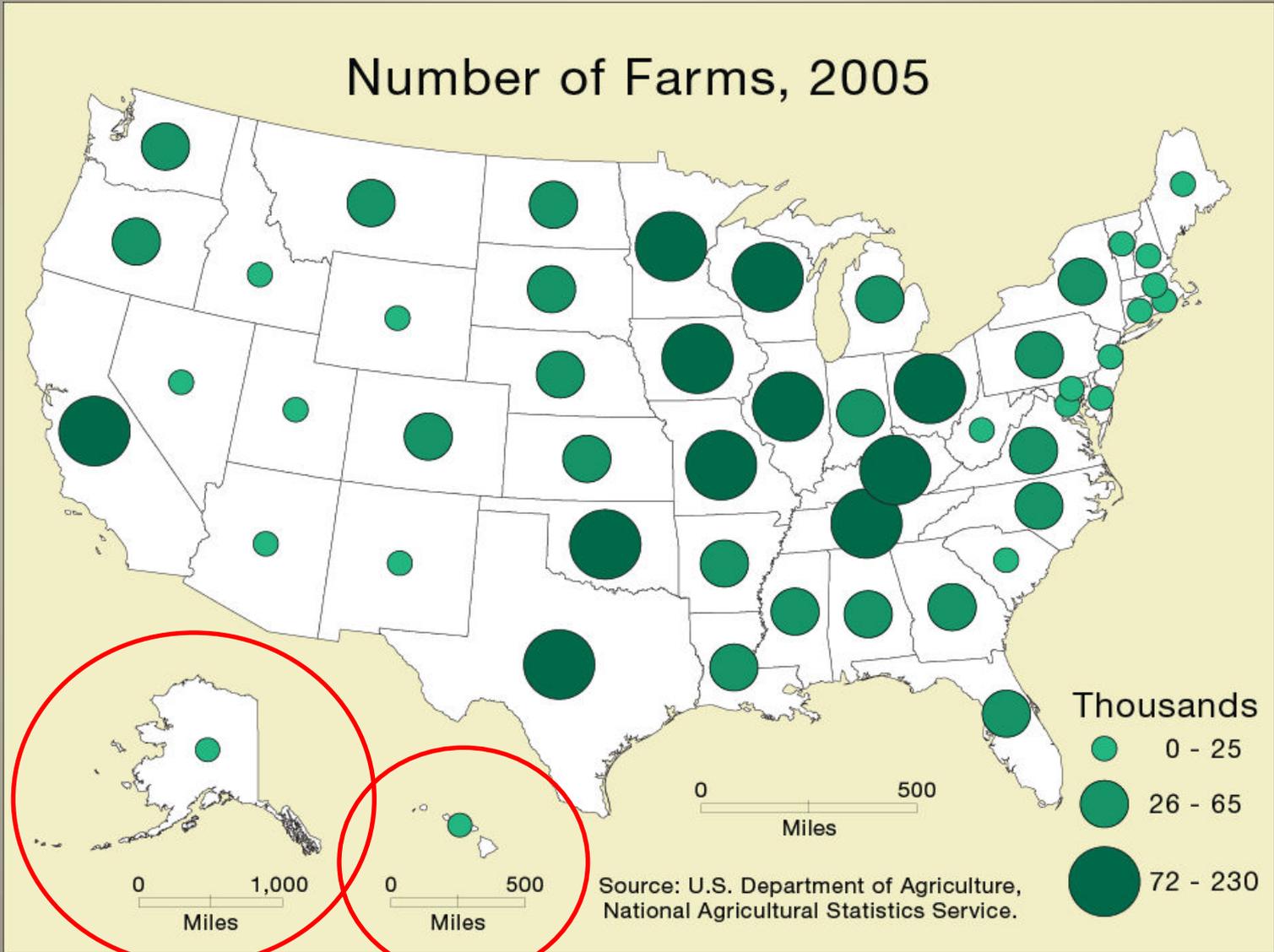
Areas shown in white are sparsely populated or uninhabited.

Source: United States Central Intelligence Agency, Map File #505103 (547149) 2-82.



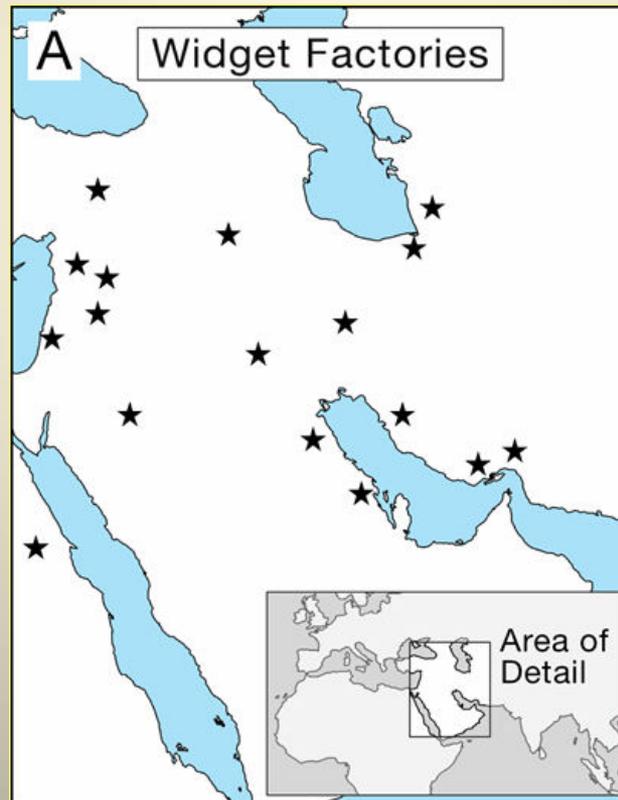
INSET

Number of Farms, 2005



INSET

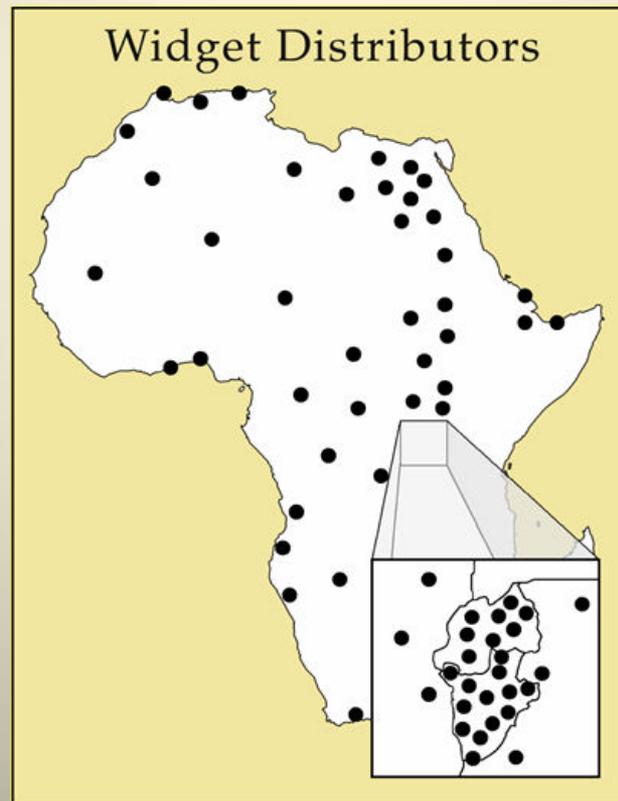
- Can be used to show the primary mapped area in relation to a larger, more recognizable area (a locator map)



Shows
Relative
Location

INSET

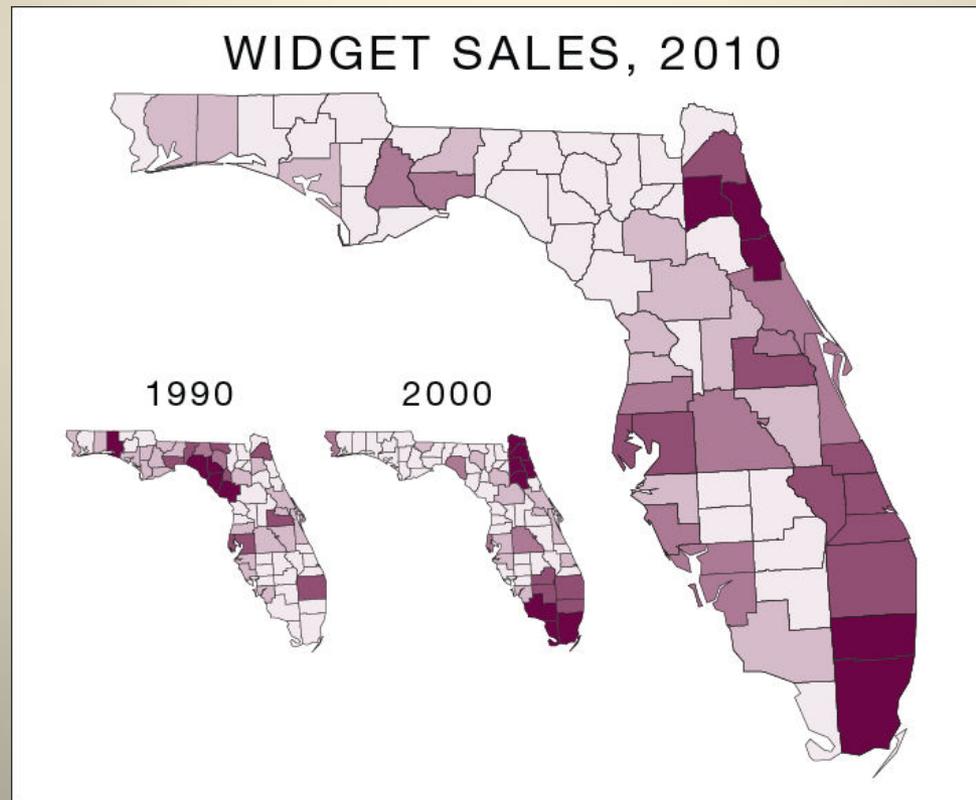
- Can be used to enlarge important or congested areas (a zoom, or blow-up map)



Shows
Enlargement
of an Area

INSET

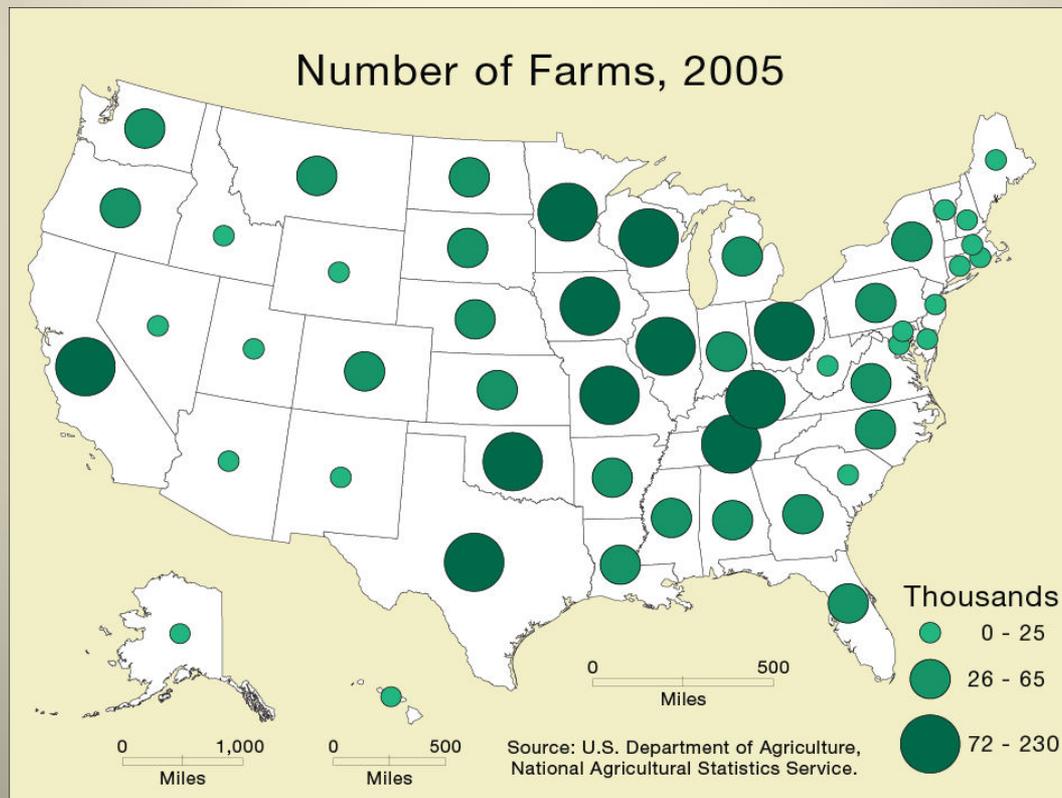
- Can be used to show topics that are related to the map's theme, or different dates of a common theme



Shows Related Themes or Dates

INSET

- Can be used to show areas that are related to the primary mapped area (different location and/or scale)



Shows Related Areas

TITLE and SUBTITLE

TITLE and SUBTITLE

- The title and subtitle tell the map user what the map is about
- Most thematic maps require a title
 - A title is sometimes omitted when a map is used as a figure in a written document, assuming that the title is clearly expressed in the figure caption
 - A well-crafted title can draw attention to a map

TITLE and SUBTITLE

Ethnolinguistic Families, Iran



- Indo-European
- Altaic
- Hamito-Semitic
- Indo-European and Hamito-Semitic

Provincial Border

Areas shown in white are sparsely populated or uninhabited.

Source: United States Central Intelligence Agency. Map File #505103 (547149) 2-82.

0 100 200 300 400
Miles

TITLE and SUBTITLE

- The Title of a thematic map is a succinct description of the map's theme
 - General reference maps typically employ the geographic region as the title
- Unnecessary words should be omitted
 - But care should be exercised to avoid cryptic abbreviations
- Don't include the word "Map" in a title!

TITLE and SUBTITLE

Long Term Debt
AVERAGE AGE, 2001
Museums of Modern Art

Appropriate Titles

Manhattan Kansas Waterlines
and Utility Covers

Map of Cougar Siting Locations in
Sierra County, California, During
the Years 2008 and 2009

MARHH_CHD CONCHO FIPS 095

Inappropriate Titles

TITLE and SUBTITLE

- The subtitle, if employed, is used to further explain the title
 - The geographic region and date are common components of the subtitle
 - The geographic region is often omitted (when it is easily identifiable)
- The subtitle should be horizontally centered below the title (center justified)

TITLE and SUBTITLE

Population Density

New Hampshire, 2010

Number of Chickens

Harper County

BIRTH RATE INCREASE

1950 - 2000

Subtitle horizontally centered below title

Titles with Subtitles

TITLE and SUBTITLE

- The style of the Title and Subtitle should be plain
 - Avoid *italics* and **ornate** type styles
 - Think twice about using **bold** (not required if appropriate type sizes are chosen)
 - Use a subtle bounding box around the title and subtitle *only* if it is necessary to mask the underlying mapped area to improve legibility

TITLE and SUBTITLE

Long Term Debt

Museums of Modern Art

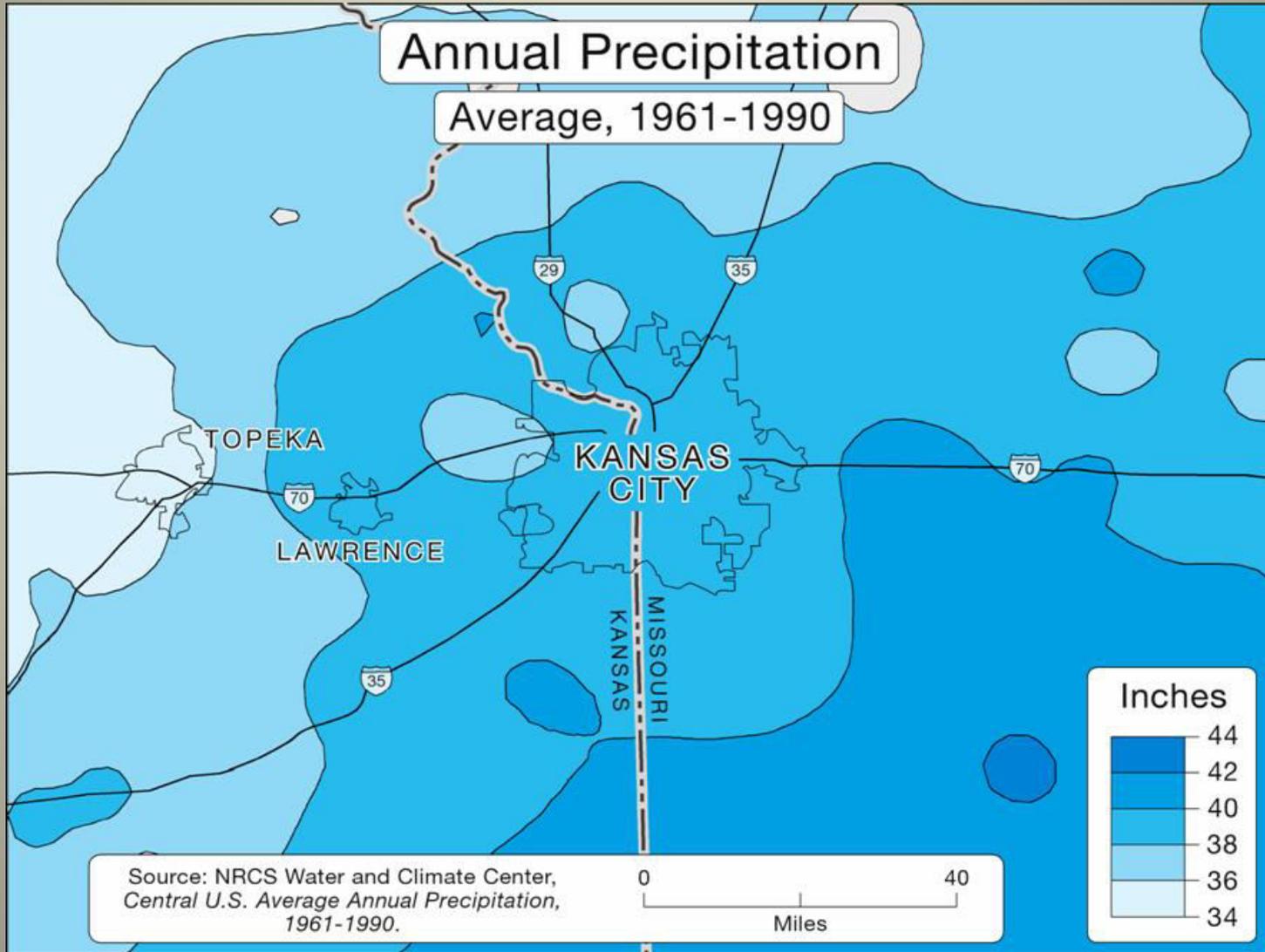
AVERAGE AGE, 2001

Inappropriate Styles

TITLE and SUBTITLE

- The title should generally be the largest type on a thematic map
 - The subtitle should be visibly smaller
- Both the title and subtitle should be limited to one line each in most cases
- If possible, place the title at top-center, where the map user is accustomed to seeing titles

TITLE and SUBTITLE



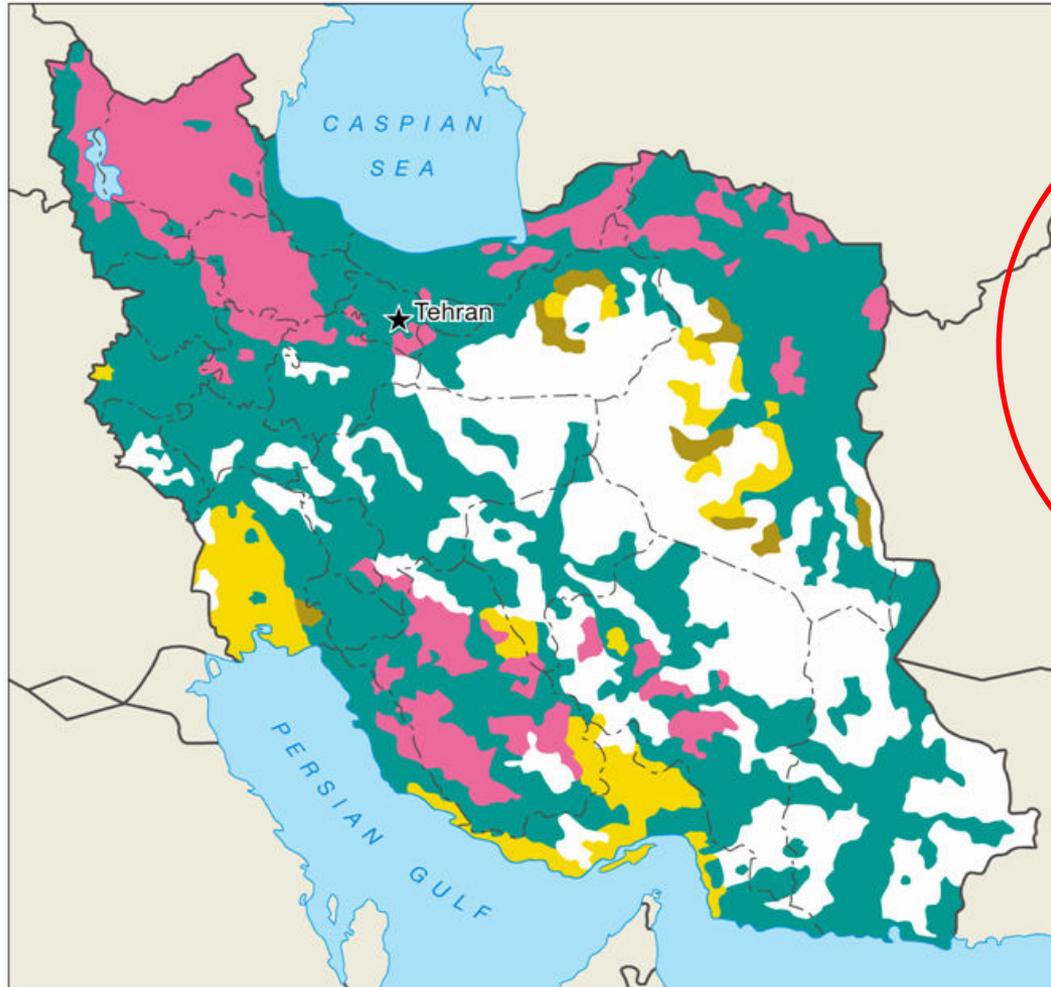
LEGEND

LEGEND

- Defines the symbols found on a map
 - On a thematic map, thematic symbols are defined, in addition to symbols for base information that are not self-explanatory
 - Legends for general reference maps often define all symbols found on the map—even if self-explanatory

LEGEND

Ethnolinguistic Families, Iran



- Indo-European
- Altaic
- Hamito-Semitic
- Indo-European and Hamito-Semitic
- Provincial Border

Areas shown in white are sparsely populated or uninhabited.

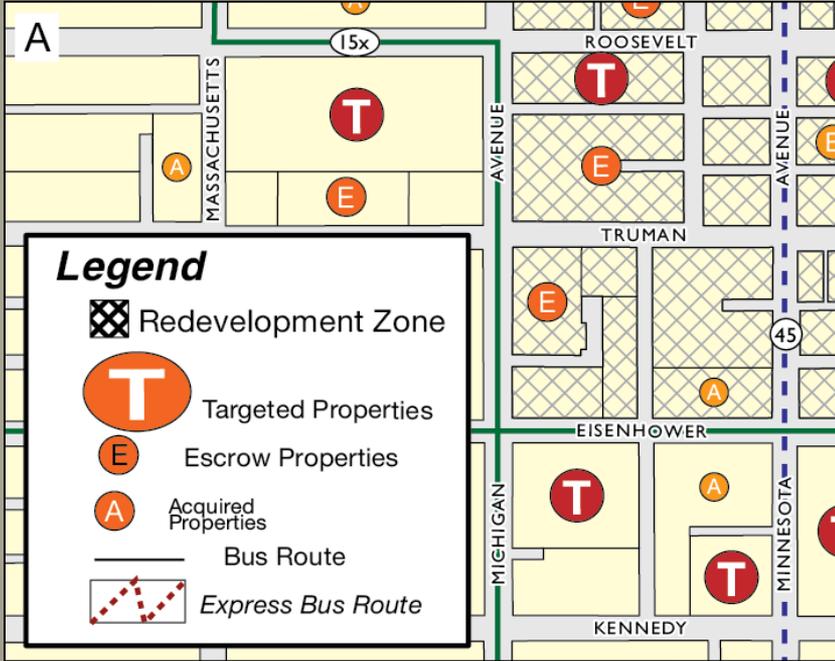
Source: United States Central Intelligence Agency, Map File #505103 (547149) 2-82.



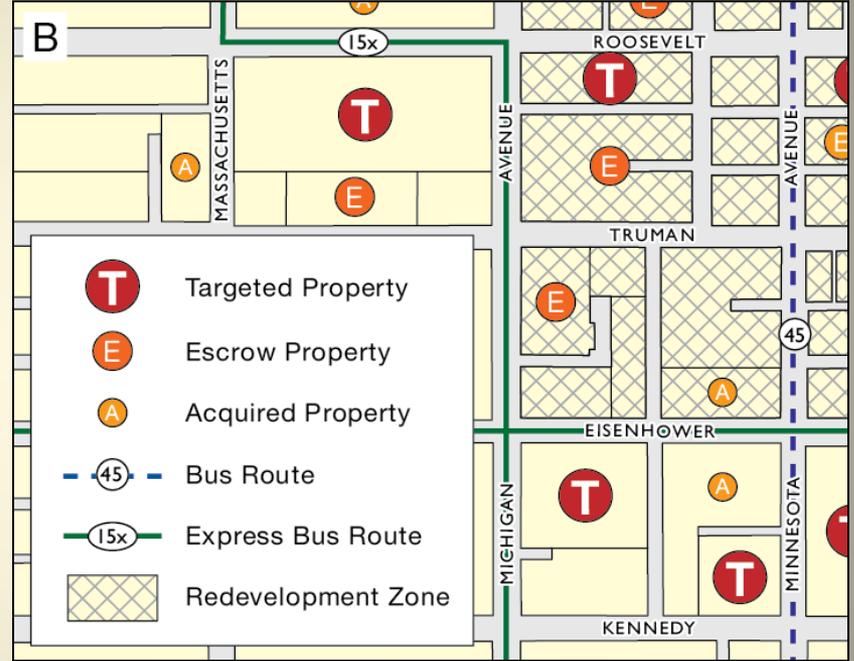
LEGEND

- The style of the legend should be clear and straightforward
 - Use a subtle bounding box around the legend only if necessary
- Ensure that symbols in the legend are *identical* to those found within the mapped area
 - This includes size, color, and orientation
- Don't include the word "Legend"!

LEGEND



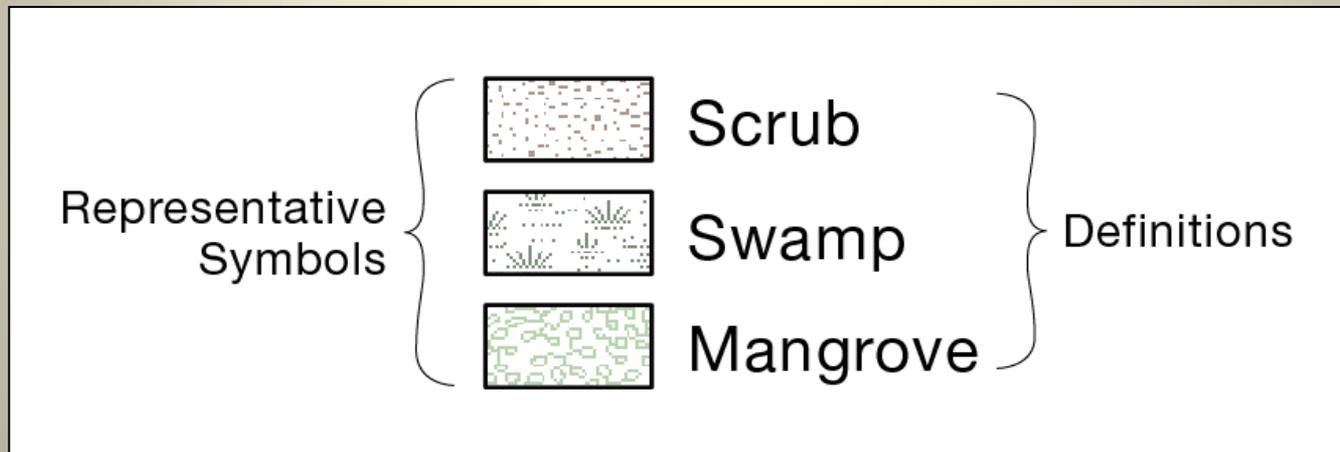
Poorly Designed



Well Designed

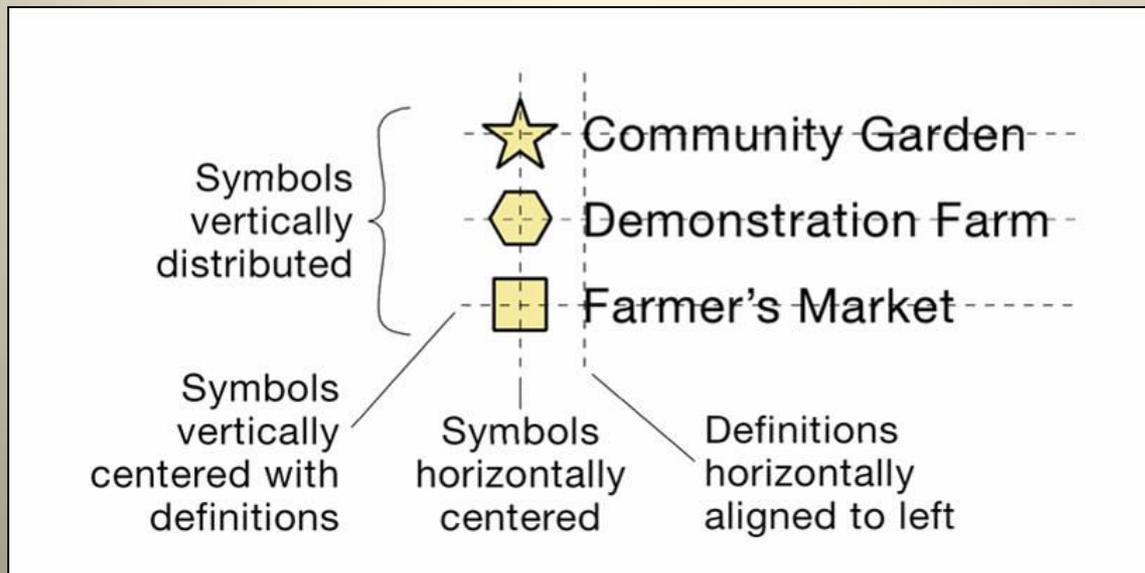
LEGEND

- Representative symbols should be placed on the left and defined to the right



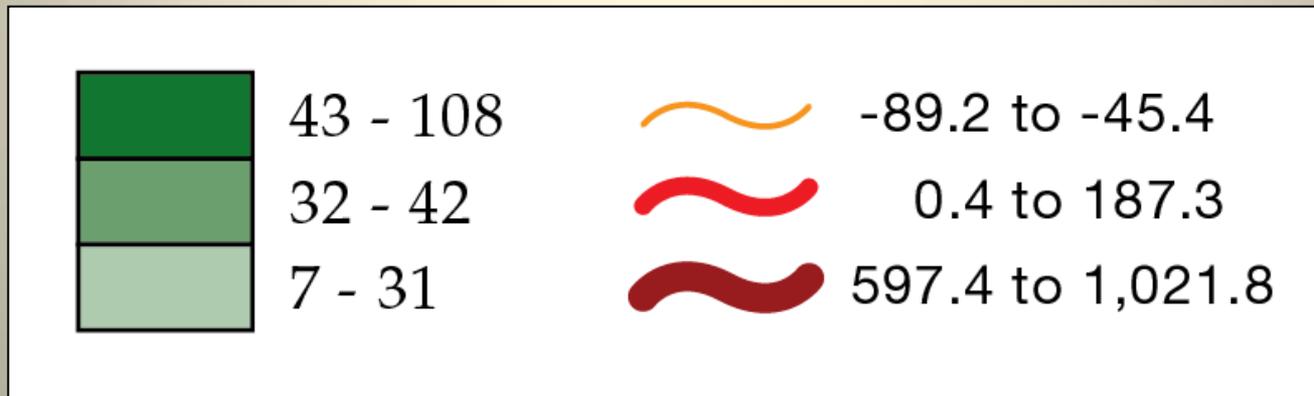
LEGEND

- Symbols should be vertically centered with their definitions
- Textual definitions and definitions consisting of individual numbers should be horizontally aligned to left



LEGEND

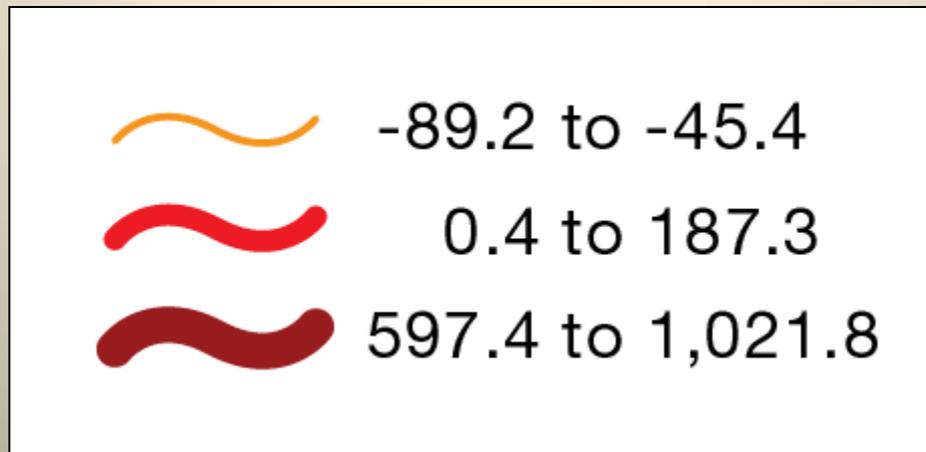
- Ranges of numbers are normally separated by a hyphen, or the word “to”
- For clarity, spaces should be included to the right and left of each separator



“to” should be used when representing negative numbers

LEGEND

- Definitions containing numbers of 1,000 or greater should incorporate commas
- Decimal numbers smaller than one should incorporate a leading zero



LEGEND

- Should values increase or decrease from top to bottom?
 - No evidence that either approach is better
 - Highest at bottom results in a more logical ordering of ranges
 - Highest at top: more = darker = higher

 10.5 to 12.9

 13.0 to 16.0

 16.4 to 22.7

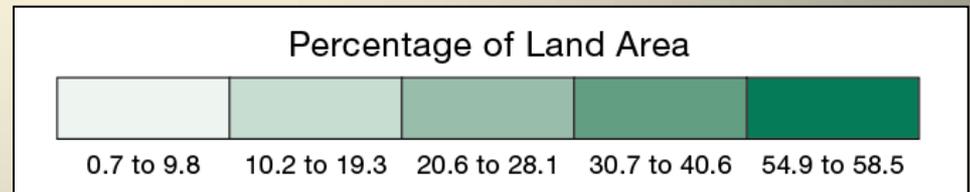
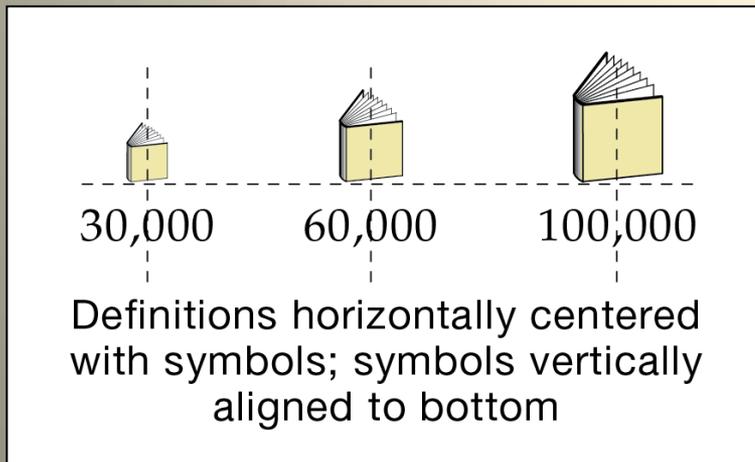
 16.4 to 22.7

 13.0 to 16.0

 10.5 to 12.9

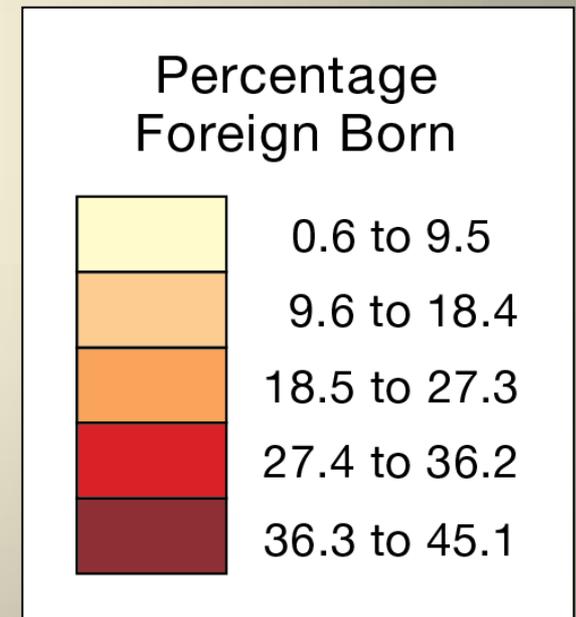
LEGEND

- The legend can be oriented in a horizontal fashion
 - Definitions are horizontally centered below the symbols they represent
 - Symbols are vertically aligned to bottom



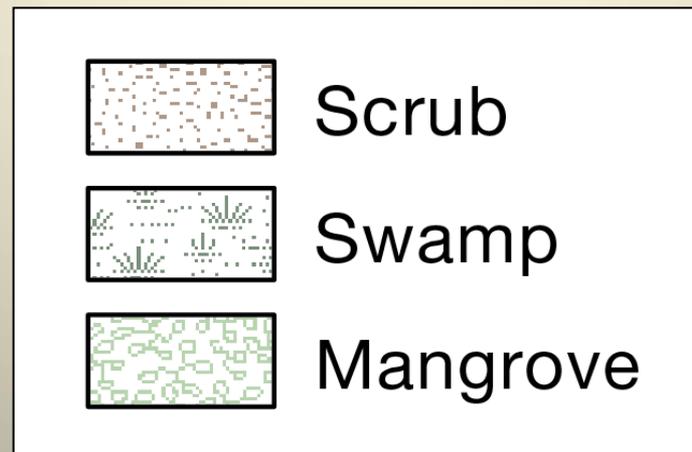
LEGEND

- Legend rectangles should be connected when representing the magnitude of an attribute
 - Areal symbols on the mapped area are usually connected
 - Connected rectangles help to emphasize the idea that a gradation of values is being represented



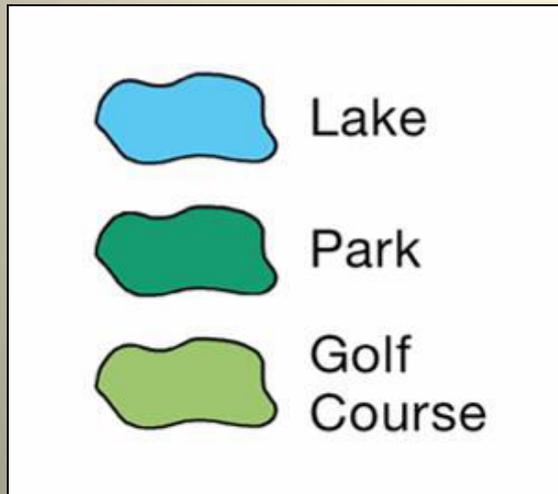
LEGEND

- Legend rectangles should be separated when representing qualitative categories of data
 - Separated rectangles help to reinforce the idea that distinctly different entities are being represented



LEGEND

- Areal symbols can be represented by irregular, amorphous polygons
 - Irregular polygons can look more natural
 - Most appropriate for qualitative categories of areal data (separated)



Appropriate



Inappropriate

LEGEND

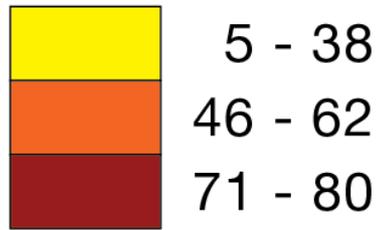
- A symbol that represents a single feature within a mapped area should be singular in the legend, not plural

- | | |
|---------|---|
| ● Well | Singular: implies that one symbol represents one well |
| ● Wells | Plural: implies that one symbol represents multiple wells |

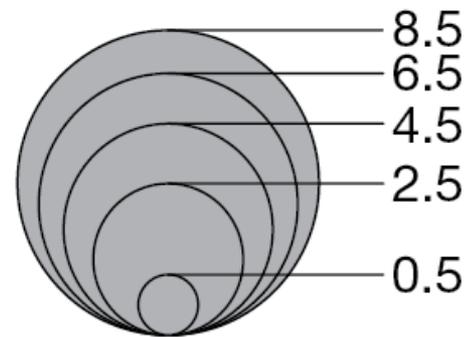
LEGEND

- A legend heading is often included to further explain the map's theme
 - The unit of measure (for quantitative data) and enumeration unit are common components of the legend heading

Percentage by Census Block Group

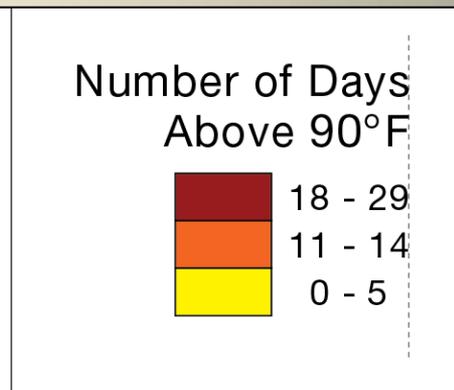
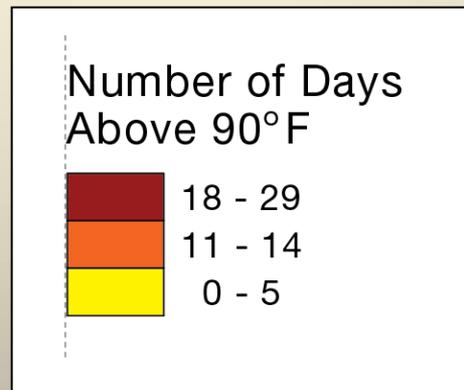
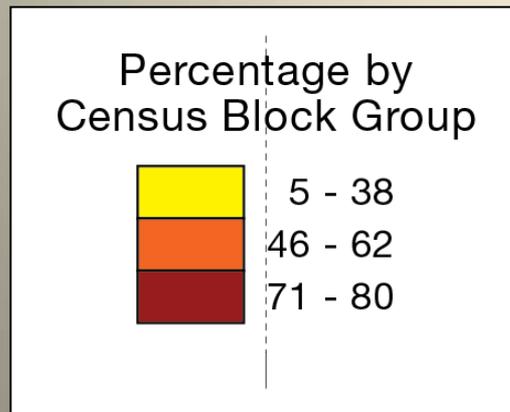


Values in Millions



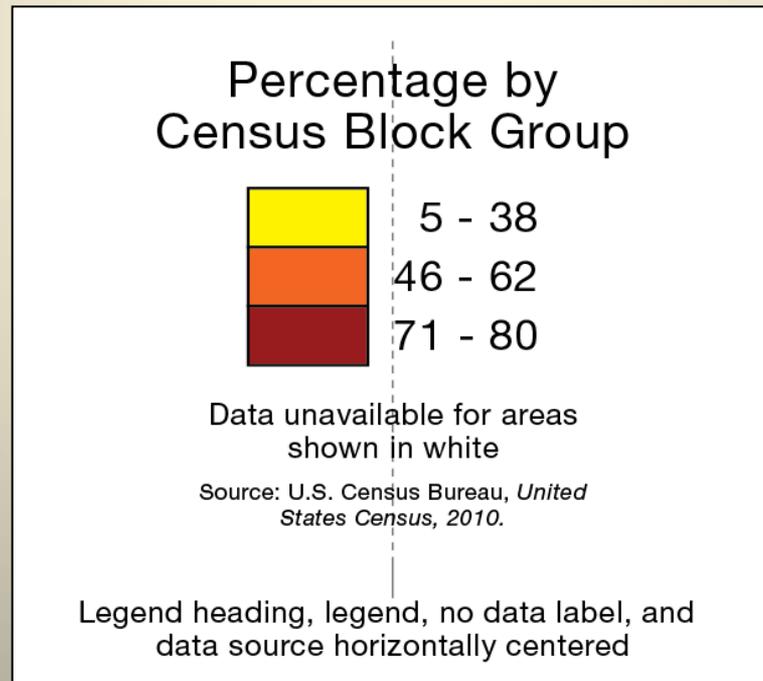
LEGEND

- The legend heading should be placed above the legend, and be horizontally centered with it
 - Multiple lines of type can be horizontally centered (center justified)
 - Horizontal centering creates a self-balancing group of objects



LEGEND

- An absence of areal data can be represented in a neutral color (white)
 - A note below the legend can inform the map user of the “no data” category



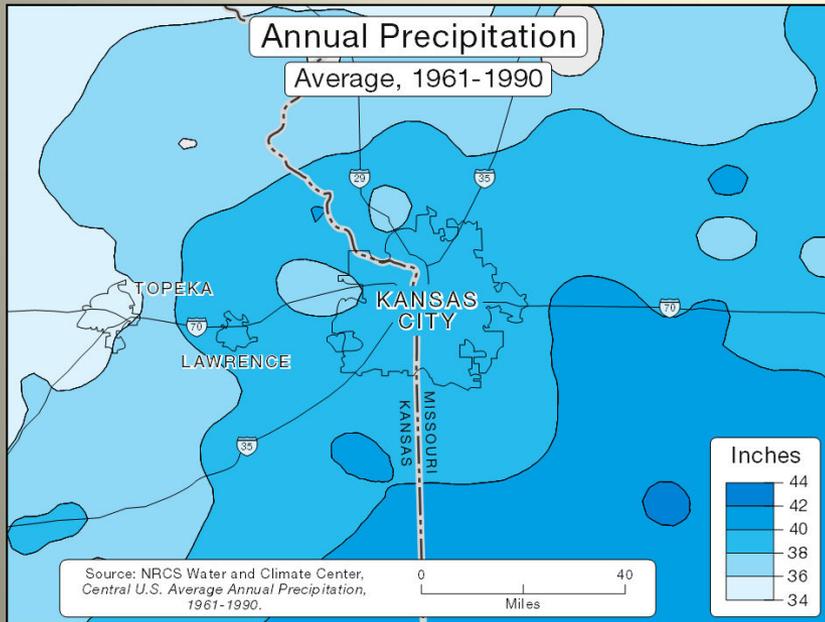
LEGEND

- Legend symbols are often organized into groups, according to a certain logic

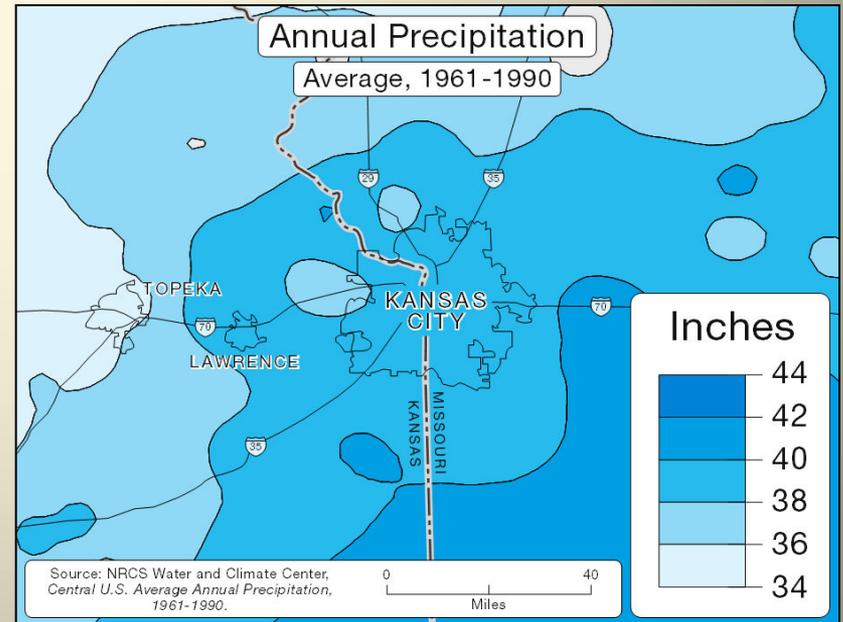
 River  Forest  Lake	 Compressor Station  Major Meter Station  Milepost  City or Town	 Compressor Station  Major Meter Station  Milepost
 Compressor Station  Major Meter Station  Milepost  City or Town	 Interstate Highway  Federal Highway  State Highway  HTG Dual Pipeline  HTG Relict Pipeline  SW&P Dual Pipeline  Southeast Pipeline  Greenville Pipeline	 HTG Dual Pipeline  HTG Relict Pipeline  SW&P Dual Pipeline  Southeast Pipeline  Greenville Pipeline
 Interstate Highway  Federal Highway  State Highway  HTG Dual Pipeline  HTG Relict Pipeline  SW&P Dual Pipeline  Southeast Pipeline  Greenville Pipeline	 City or Town  Interstate Highway  Federal Highway  State Highway  River  Forest  Lake	 City or Town  Interstate Highway  Federal Highway  State Highway  River  Forest  Lake

LEGEND

- The legend should be large enough to be useful
 - But not so large as to occupy vast areas of space, or challenge thematic symbols



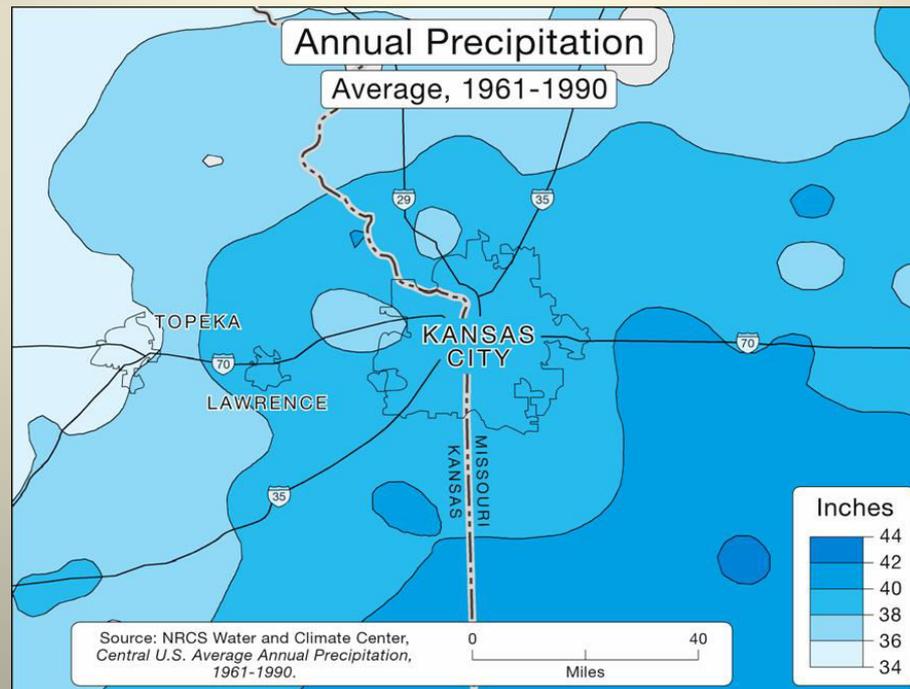
Large Enough



Too Large

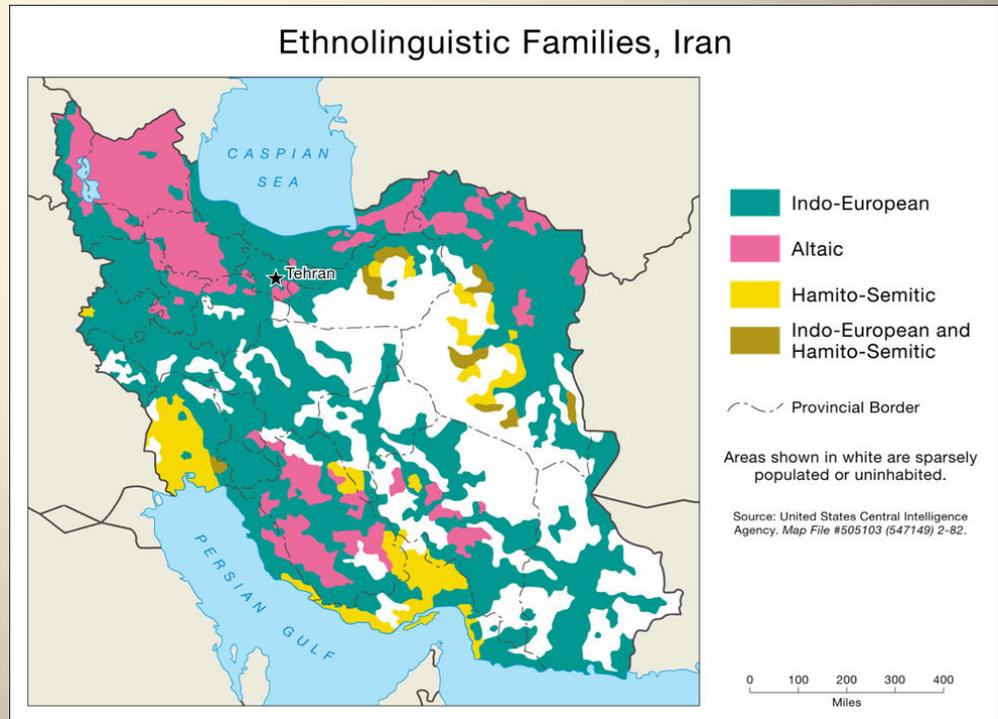
LEGEND

- The legend heading should be smaller than the subtitle
 - Legend definitions should be smaller than the legend heading



LEGEND

- If possible, the legend should be visually centered within a larger portion of available space



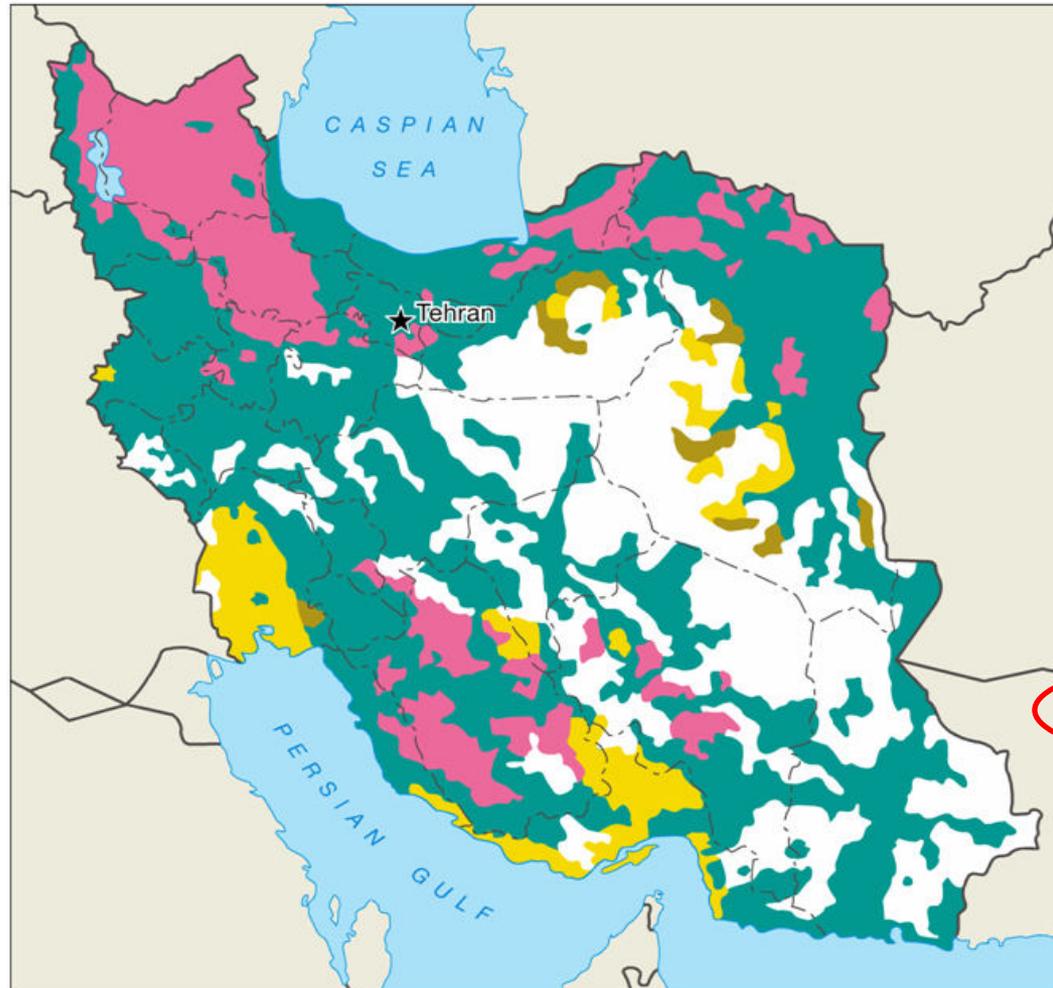
DATA SOURCE

DATA SOURCE

- Allows the map user to determine where thematic data were obtained
 - Sources of base information are normally omitted from thematic maps
- Should be formatted similar to a standard bibliographic reference
 - But is often more concise and less formal

DATA SOURCE

Ethnolinguistic Families, Iran



- Indo-European
- Altaic
- Hamito-Semitic
- Indo-European and Hamito-Semitic

Provincial Border

Areas shown in white are sparsely populated or uninhabited.

Source: United States Central Intelligence Agency, Map File #505103 (547149) 2-82.

0 100 200 300 400
Miles

DATA SOURCE

- The words “Data Source:” or “Source:” should be included to avoid ambiguity
 - The data source indicates where data came from, not map authorship
 - A separate block of type can be used to indicate map authorship

Source: Census 2010, *Summary File 3*, U.S. Census Bureau.

Data Source: *ESRI Data & Maps*, 2007.

Source: United States Central Intelligence Agency.
Map File #505103 (547149) 2-82.

Data Source: National Atlas of the United States,
<http://www-atlas.usgs.gov/mld/huralll.html>

DATA SOURCE

- The style of the data source should be plain and subtle
- Publication names should be italicized
- Multiple lines of type should be horizontally centered (center justified)

Source: The International Bank for Reconstruction and
Development/The World Bank.

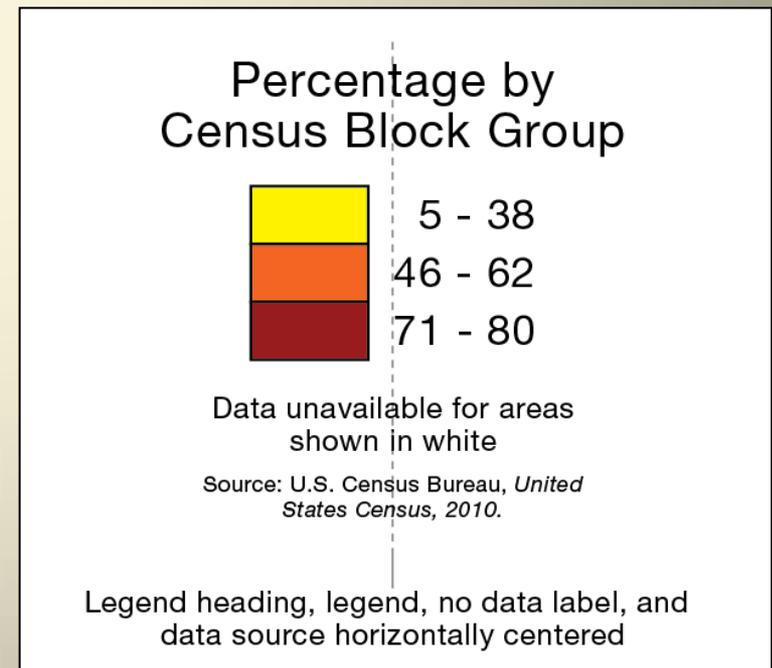
World Development Report, 2000: Poverty.

Source: Field Survey by Nigel Tufnel and
David St. Hubbins. December, 2008.

Multiple lines are horizontally centered

DATA SOURCE

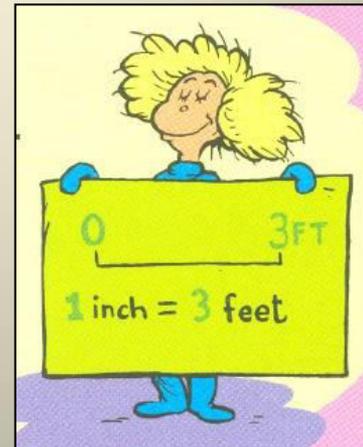
- The data source should be among the smallest type on a map
 - Its purpose is to inform the curious, not to attract attention
- Optimally, the data source is horizontally centered below the legend



SCALE

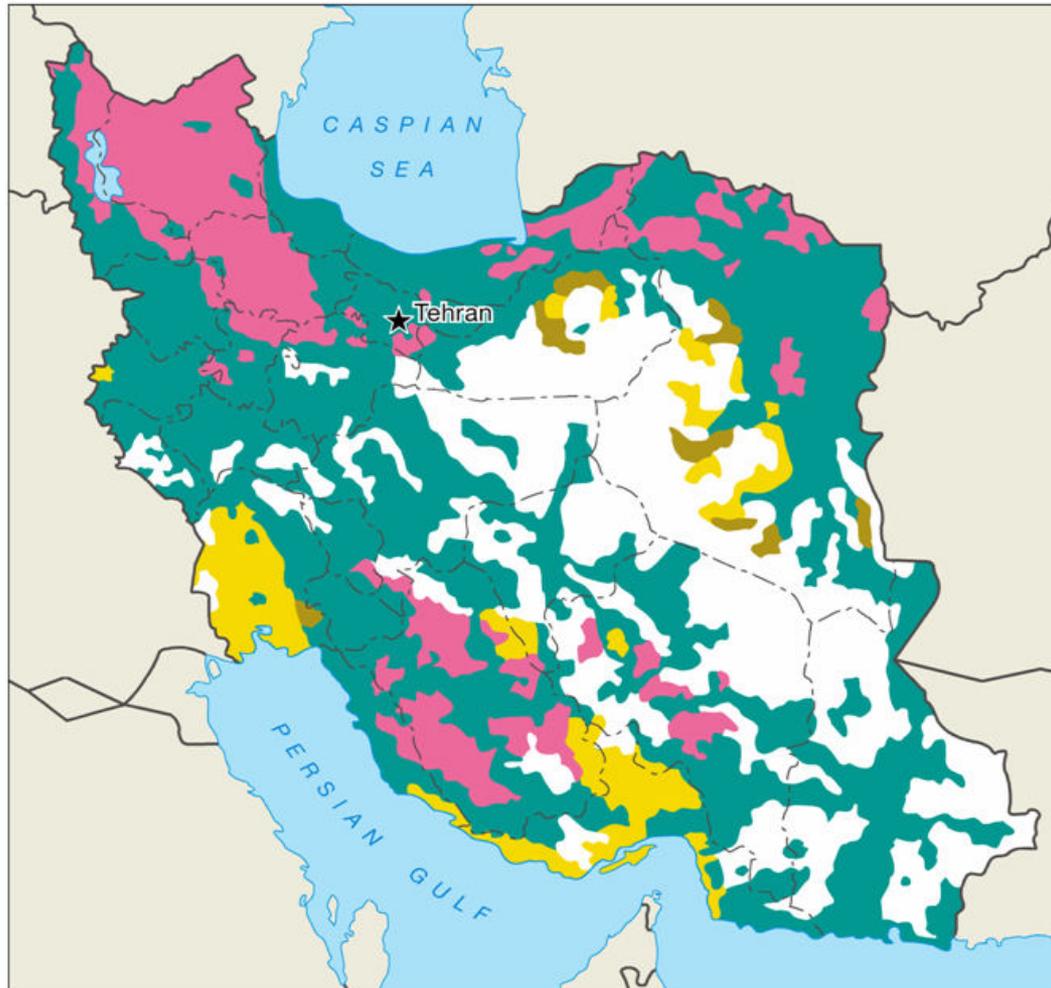
SCALE

- Indicates the amount of reduction that has taken place on a map, or allows the map user to measure distances
- Can take three forms
 - Representative Fraction (1:24,000)
 - Verbal Scale (“One Inch to the Mile”)
 - Bar Scale or Scale Bar



SCALE

Ethnolinguistic Families, Iran



- Indo-European
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Provincial Border

Areas shown in white are sparsely populated or uninhabited.

Source: United States Central Intelligence Agency, Map File #505103 (547149) 2-82.

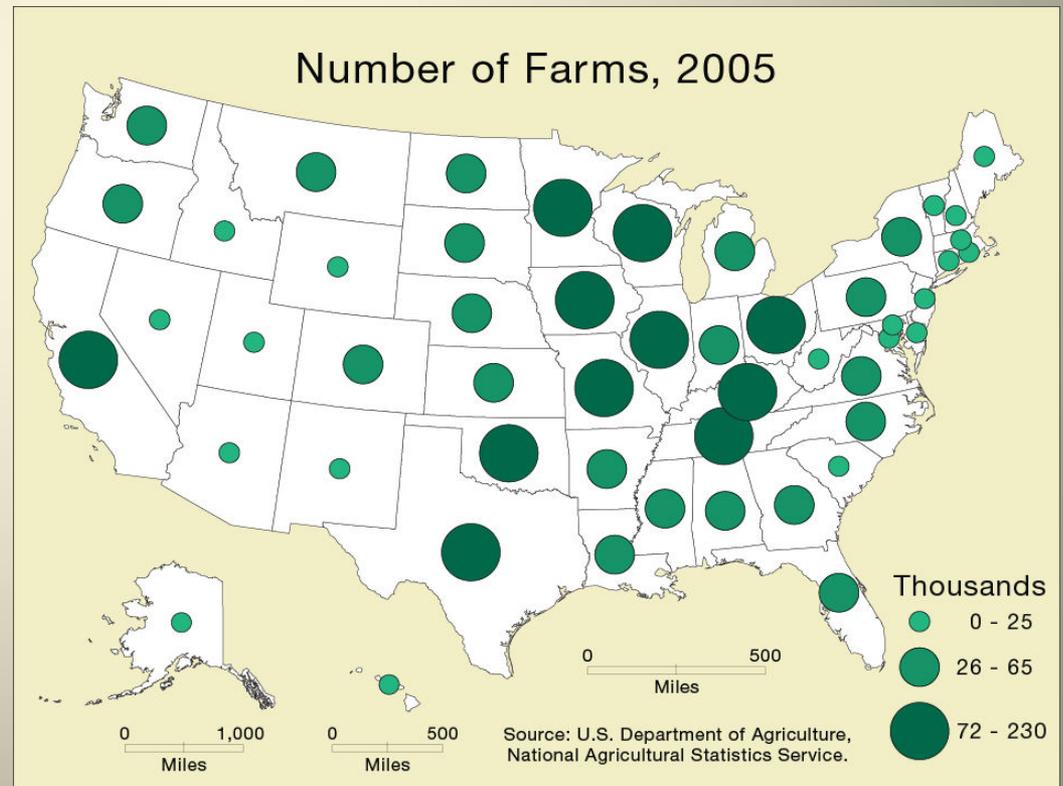


SCALE

- The bar scale is the preferred format for inclusion on a thematic map
 - Resembles a ruler that can easily be used to measure distances on a map
 - Remains true when a map is enlarged or reduced (representative fractions and verbal scales don't)

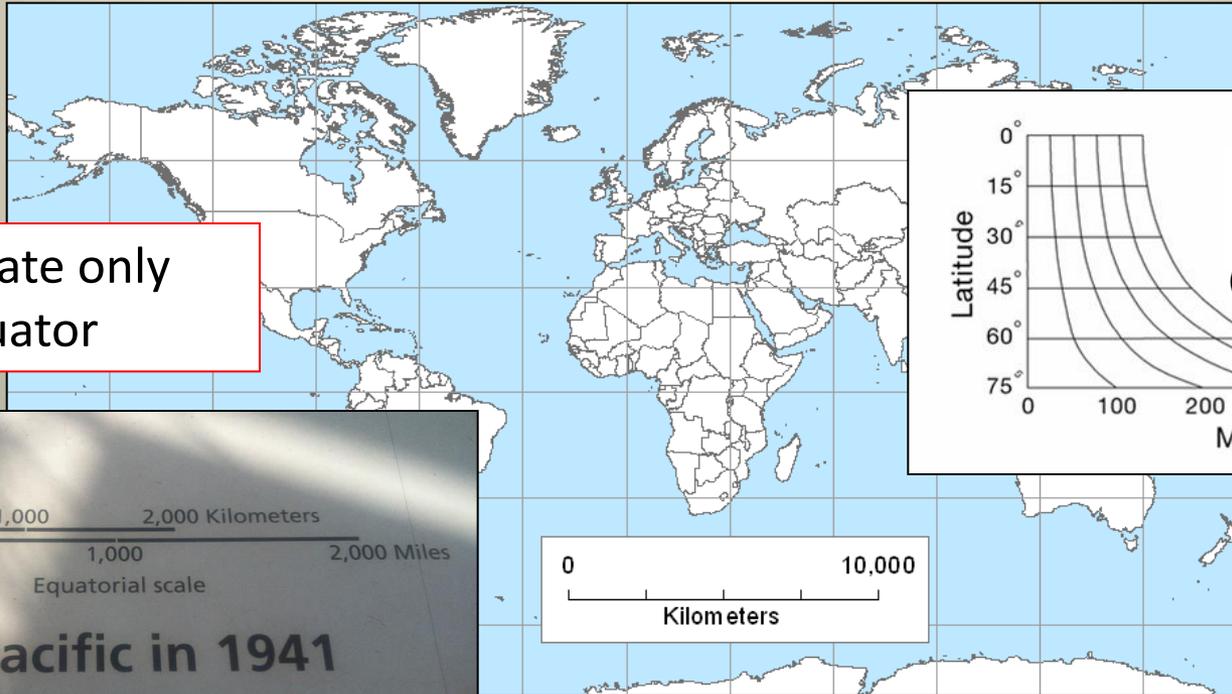
SCALE

- Include a bar scale on a thematic map if distance information can enhance the map user's understanding of the theme

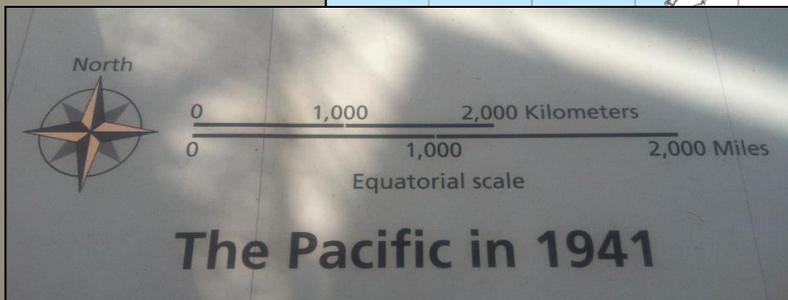
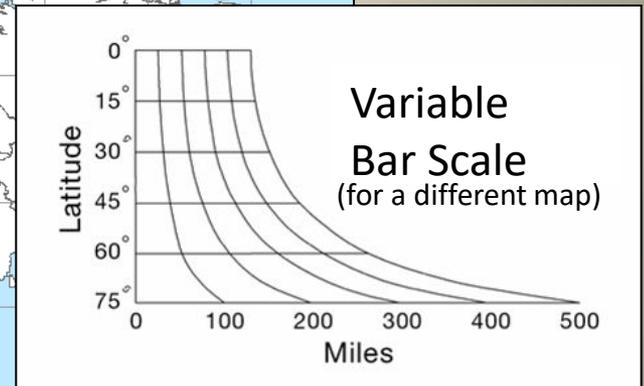


SCALE

- Use caution when employing bar scales on smaller scale maps
 - Scale is only accurate along standard lines

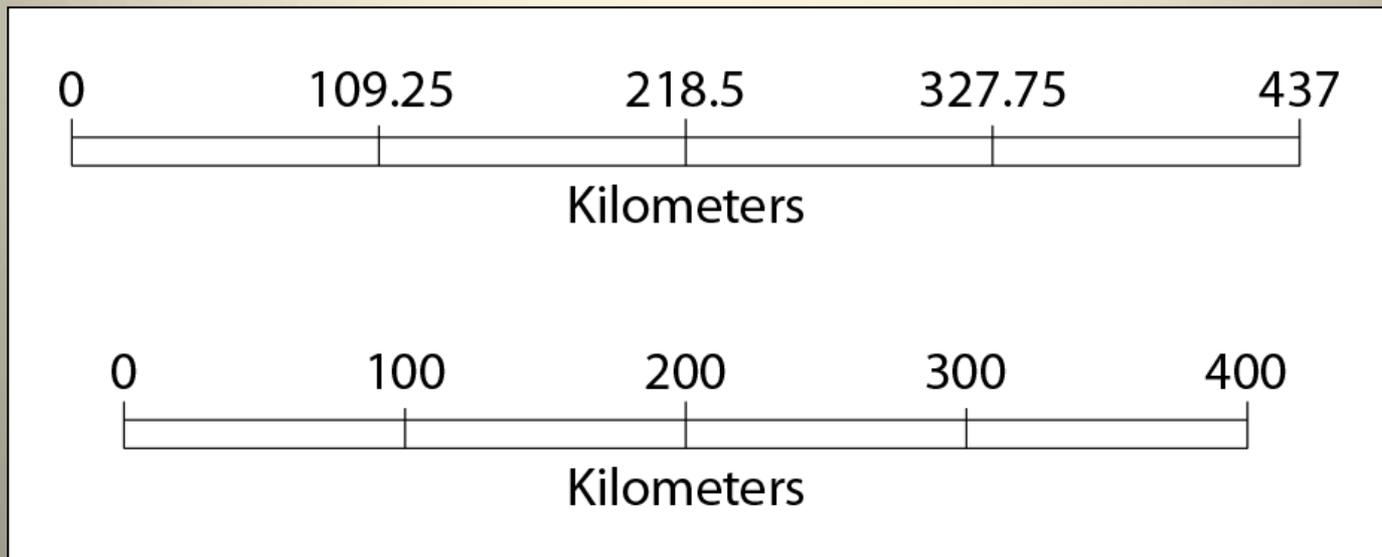


Scale is accurate only along the equator



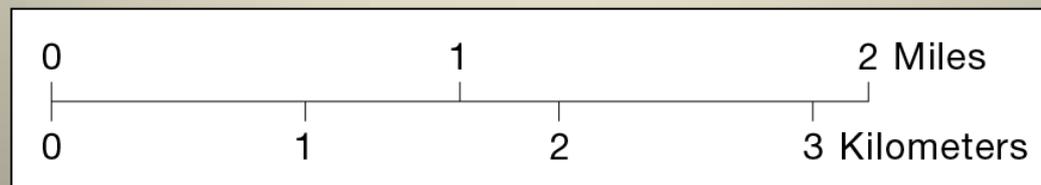
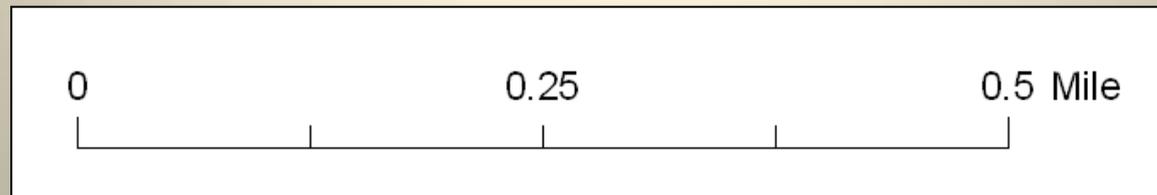
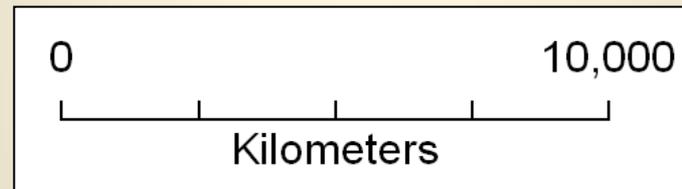
SCALE

- The maximum distance value should always be round and easy to work with
- Decimal values such as 327.75 are difficult to work with and should be avoided in favor of integers



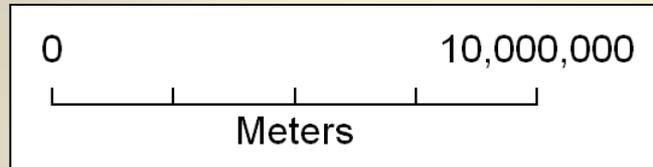
SCALE

- Incorporate a unit of measure that is appropriate for the intended audience
 - Incorporate both miles and kilometers if necessary

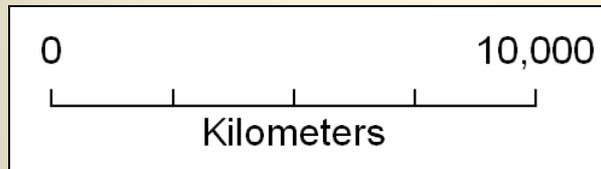


SCALE

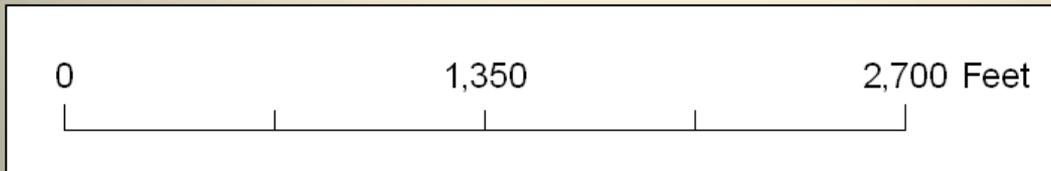
- Choose a unit of measure that is appropriate for the maximum value



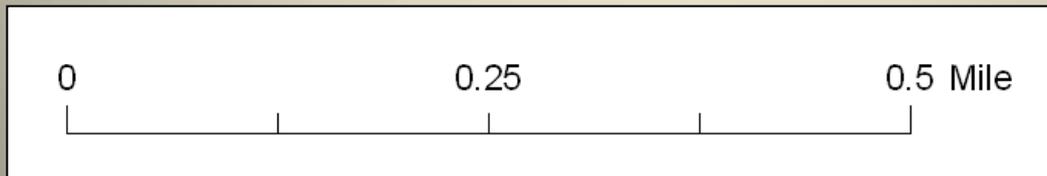
Inappropriate



Appropriate



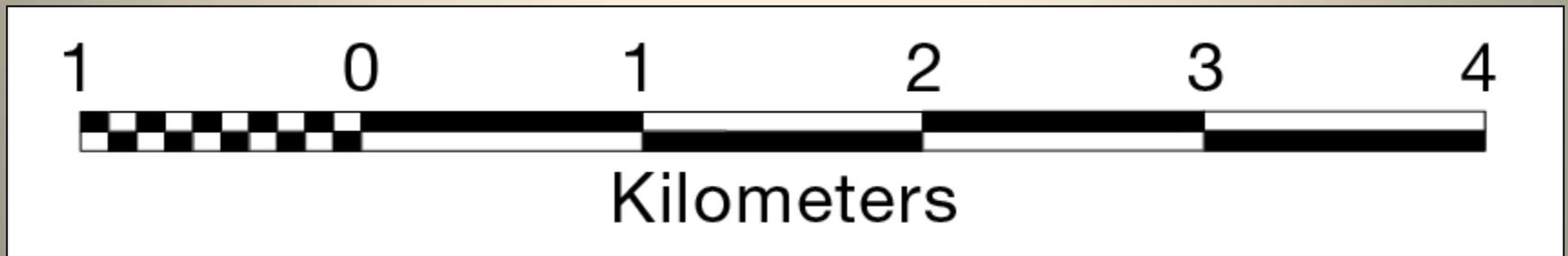
Inappropriate



Appropriate

SCALE

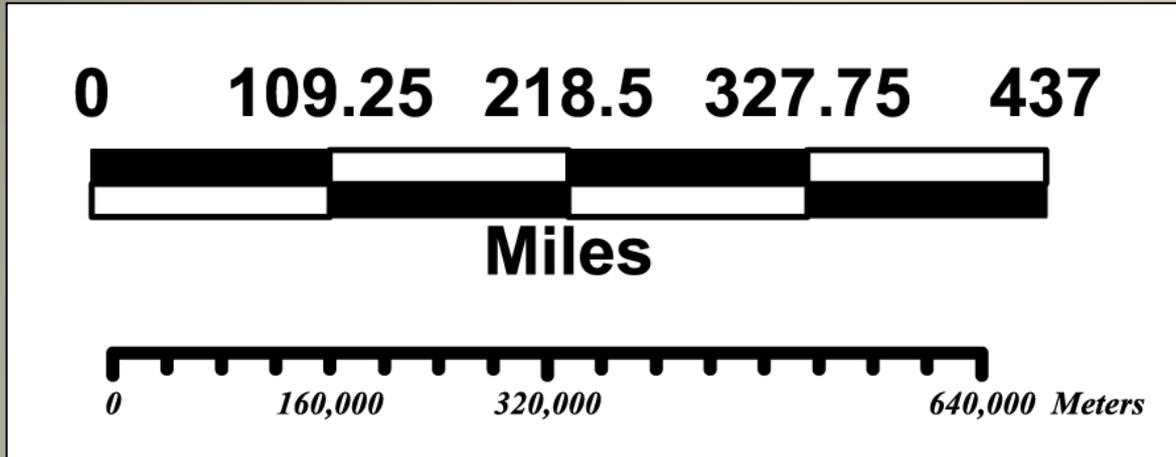
- Don't use an "extension scale" unless the map user requires it
 - The extension scale can be useful when employing a specific method of map measurement, but is also a source of confusion for many map users



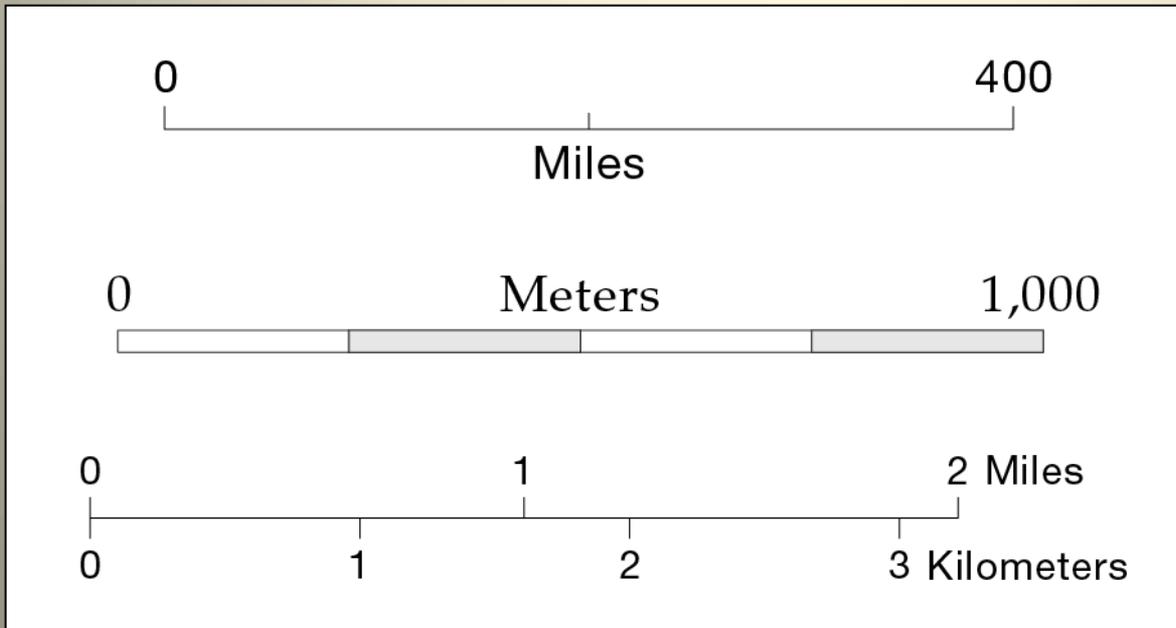
SCALE

- The style of the bar scale should be simple and subtle; it should not attract attention
 - Bulky and complex designs should be avoided
 - Line weights should be fine and type should be among the smallest on a map
 - Avoid the use of bold and italic type styles
 - Include a small number of intermediate tic marks

SCALE



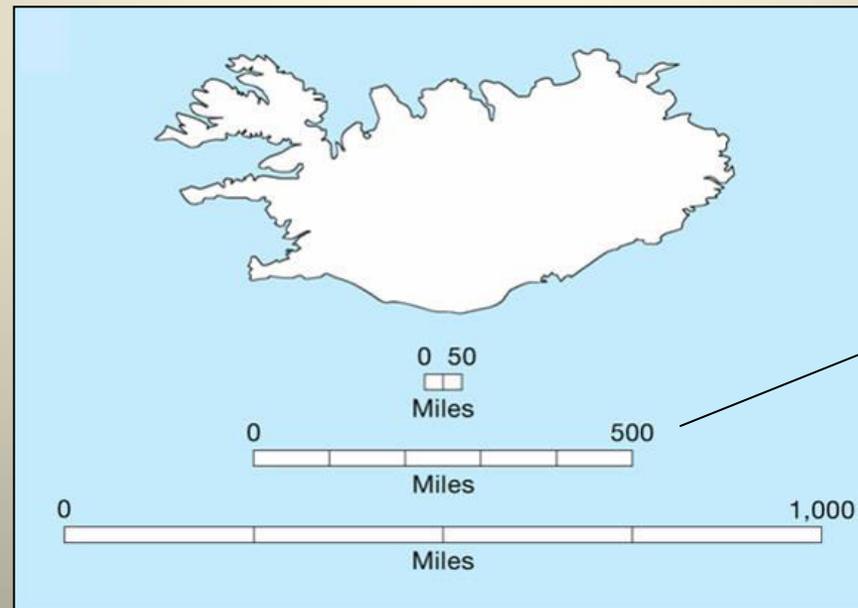
Poorly Designed



Well Designed

SCALE

- The bar scale should be long enough to be useful but not so long as to be cumbersome
 - Experiment to arrive at an appropriate length and an appropriate maximum value

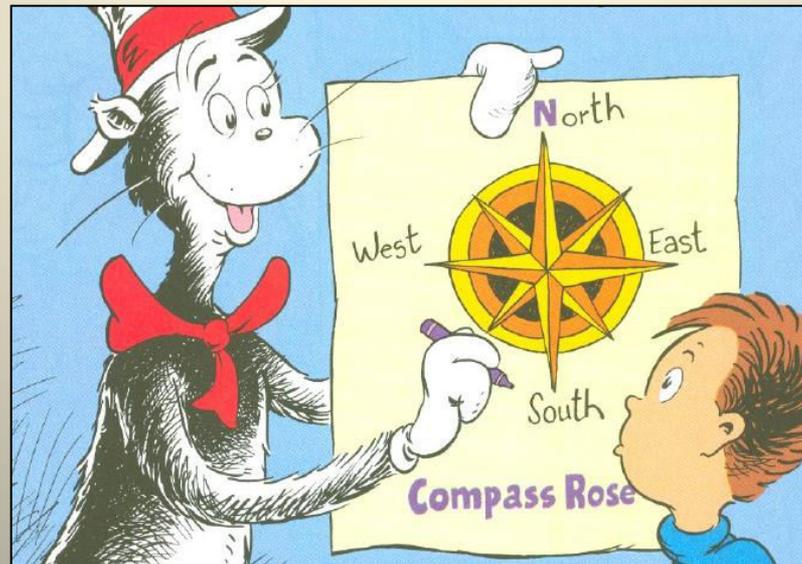


Most Appropriate

ORIENTATION

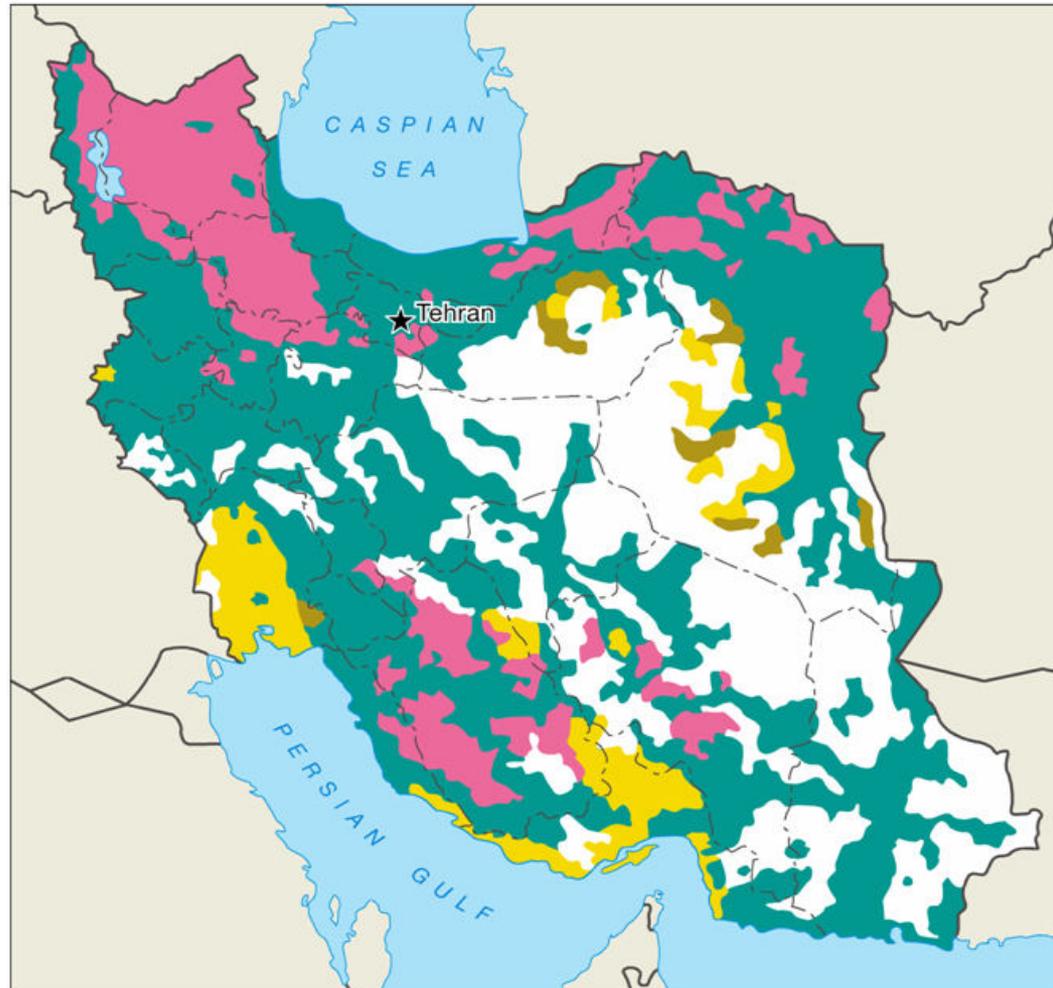
ORIENTATION

- The indication of north on a map
- Orientation can be indicated by a
 - North Arrow
 - Graticule (a system of grid lines, normally representing longitude and latitude)



ORIENTATION

Ethnolinguistic Families, Iran



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- Altaic
- Hamito-Semitic
- Indo-European and Hamito-Semitic

Provincial Border

Areas shown in white are sparsely populated or uninhabited.

Source: United States Central Intelligence Agency, Map File #505103 (547149) 2-82.

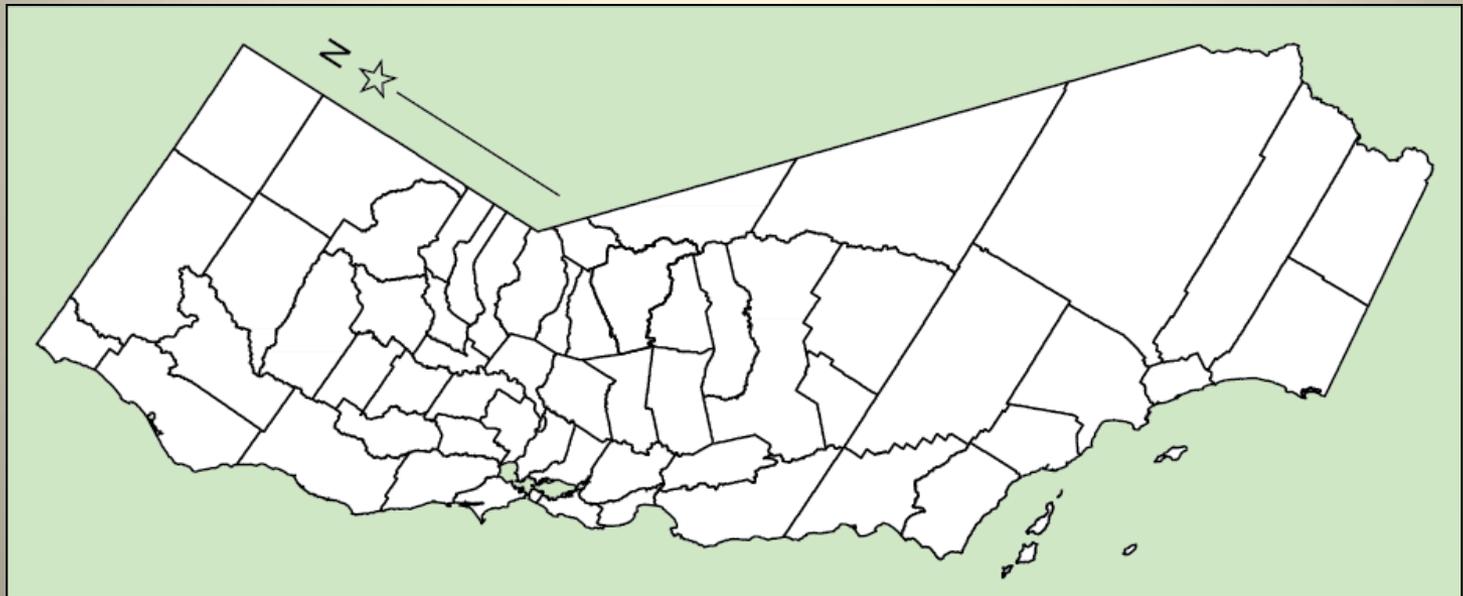


ORIENTATION

- A north arrow is *not required on every map!*
 - The orientation of maps with north at the top is a long-standing tradition
 - It is assumed that “north is at the top” of most modern maps

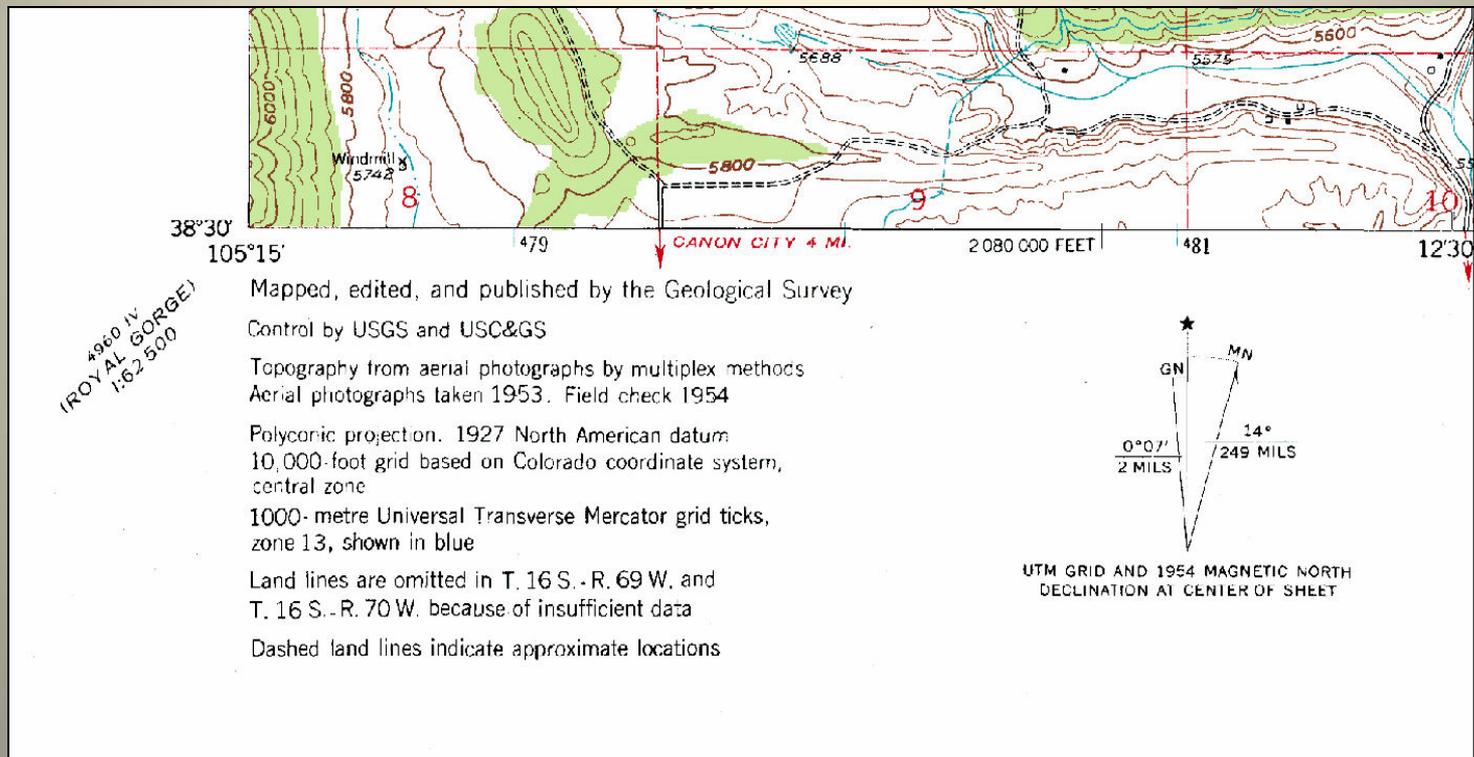
ORIENTATION

- Include an indication of orientation if
 - The map is *not* oriented with geographic or “true” north at the top



ORIENTATION

- Include an indication of orientation if
 - The map is intended for use in navigation, surveying, orienteering, etc.



ORIENTATION

- Include an indication of orientation if
 - Geographic features are oriented in a manner that might confuse the map user



ORIENTATION

- A graticule indicates direction through the orientation of grid lines
 - Typically meridians that run north–south
 - The graticule can also provide positional information, such as latitude and longitude



ORIENTATION

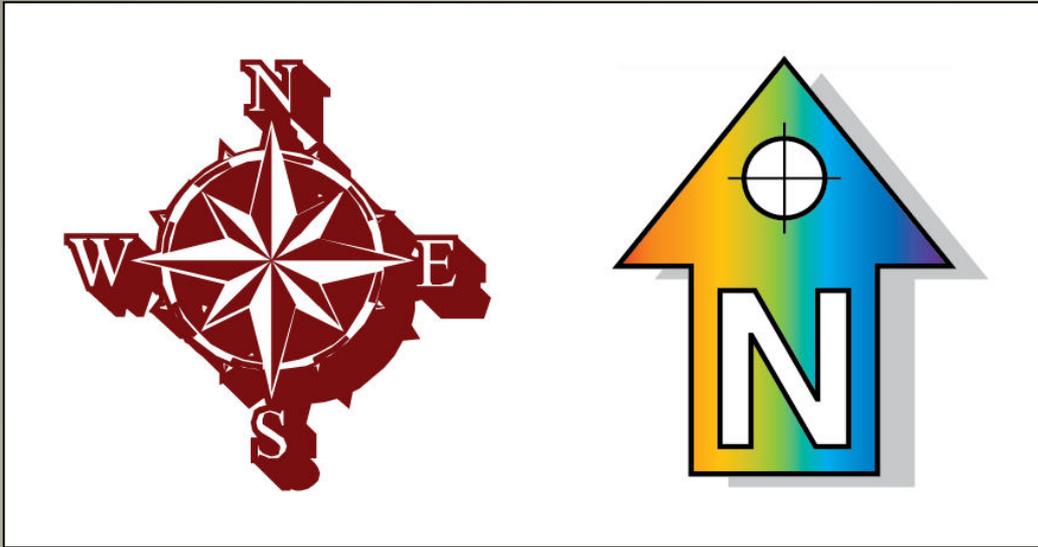
- Use caution when using north arrows on smaller scale maps
 - The direction of north can differ greatly



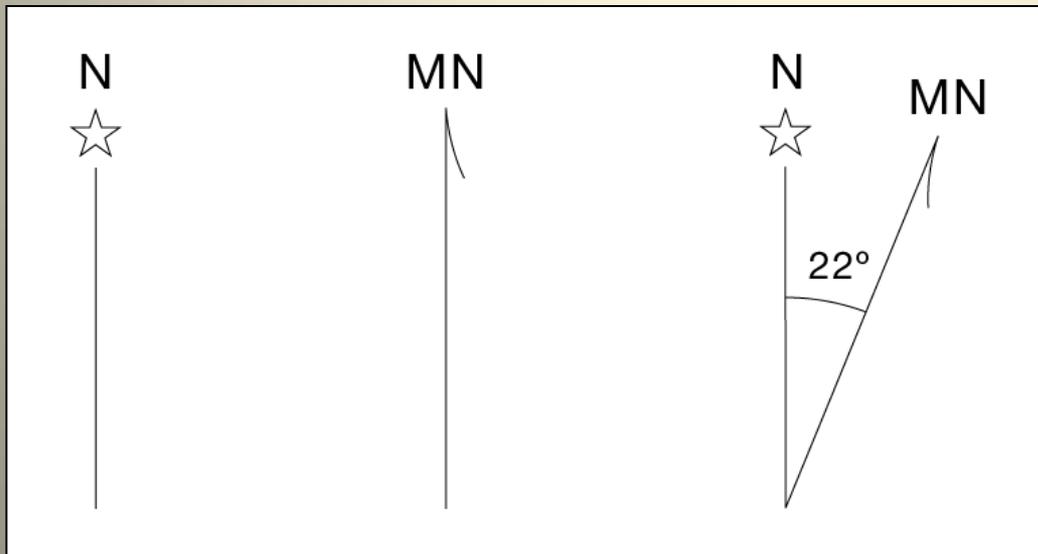
ORIENTATION

- The style of the north arrow and graticule should be simple and subtle; they should not attract attention
 - Bulky and complex designs should be avoided
 - Line weights should be fine and type should be among the smallest on a map
 - Only north should be indicated (if necessary, the map user can infer the other cardinal directions)

ORIENTATION



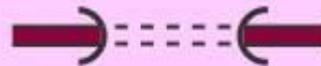
Poorly Designed



Well Designed



Map symbols



Click here



What are map symbols?

- Maps give us a lot of information and there is not much room for labels.
- So we use symbols to save space and make the map easier to read.
- Symbols may be simple drawings, letters, shortened words or coloured shapes or areas.



Conventional signs and symbols

•Features which have to be repeatedly represented on maps are depicted by special signs and symbols. The signs bear some pictorial resemblance to the original feature and their meaning is quiet clear. Some conventional signs need to be studied closely before they can be recognized.

•Point, line and area symbols are used to depict various physical and cultural features. They can be in the form of alphabets, figures, signs or colour wash.

The Survey Of India (SOI) have standardized a set of conventional signs and symbols to be used in topographical maps.

Black

Brawn

Blue

Green

Yellow

Red

White

Roads, metalled : according to importance; distance stone	
Roads, unmetalled : according to importance; bridge	
Cart-track, Pack-track and pass. Foot-path with bridge	
Streams : with track in bed; undefined. Canal	
Dams: masonry or rock-filled; earthwork, Weir	
River dry with water channel; with islands and rocks. Tidal river	
Swamp, Reeds	
Wells : lined; unlined. Spring. Tanks : perennial: dry	
Embankments : road or rail	
Railway, broad gauge : double; single with station; under construction	
Railway other gauges : double; single with distance stone; under constrn.	
Light Railway or tramway, Telegraph line. Cutting with tunnel	
Contours, Cliffs	
Sand features (1) flate (2) sand hills (permanent) (3) dunes (shifting)	
Towns or Villages : inhabited ; deserted. Fort	
Huts : permanent; temporary. Tower Antiquities	
Temple. Chhatri. Church. Mosque. Idgah. Tomb. Graves.	
Lighthouse, Lightship. Buoys : lighted ; unlighted. Anchorage	
Mine. Vine on trellis. Grass. Scrub	
Palms : Palmyra; other. Plantain. Conifer. Bamboo. Other trees.	
Boundary, international	
Boundary, state : demarcated; undemarcated	
Boundary, district : subdivision, tahsil or taluk; forest	
Boundary, pillars : surveyed; unlocated; village trijunction	
Heights, triangulated : station; point; approximate	Δ 200 • 200 . 200
Bench-mark : geodetic; tertiary; canal	BM 63.3, DM 63.3, .63
Post office. Telegraph Office. Combined office. Police station.	PO, TO, PTO, PS
Bungalows; dak or travellers; inspection. Rest-house	DB, IB, RH
Circuit house. Camping ground.	CH, CG
Forest : reserved: protected	RF, PF

A number of methods have been used to show the relief features of the Earth's surface on maps, over the years. These methods include hachure, hill shading, layer tints, benchmarks and spot heights and contours. However, contours and spot heights are predominantly used to depict the relief of an area on all topographical maps.

Figure 11.1 Conventional Signs and Symbols

ACTIVITY 1

Label the map elements in the given map

